LATE SUMMER
2011

Vol. 23 N° 2 £4.50

Archive

The subscription magazine for users of the Acorn Archimedes and its successors

Newsbriefs ... ... Jim Nagel ... 2
Raspberry Pi at London show; Armini OS upgrade; TBA Software returns to Risc os; Netsurf reaches 2.8; Pipedream goes freeware; USB challenge; Organizer offer for Archive members; Spellings move; Colossus rebuilder dies; No Phorm prosecution

New Arms for Risc os ... ... Trevor Johnson ... 12
More Raspberry Pi; Genesis Efika Smarttop

Mac Matters ... ... Mark Stephens ... 15
Steve Jobs; Lion; Screen modes; Organizer

Free to share: PD column ... ... Steve Fryatt ... 17
Wrangler; Postscript utilities; Strongmen; Coolswitch

The cookie crumbles ... ... Nat Queen ... 23
New legislation — Alternative browser elevates privacy

Wakefield 2011 ... ... Ron Briscoe ... 26

Deutsche Riscos-Treffungen ... ... Jim Nagel ... 31
Summer meetings in Germany east and west

Wikipedia and Riscos ... ... Trevor Johnson ... 34

Connectivity ... ... Gerald Fitton ... 38

Datapower: *accented letters* ... ... Julian Fry ... 45

Compiling with GCC (18) ... ... Rob Johnson ... 49

Secret life of algorithms (5) Nicholas Cutler ... 55
Fast Fourier Transform

Going round in circles (Sound 30) Jim Lesurf ... 60

hint&tip: *Impression pamphlet & a duplex printer* ... 19

Archive files to download 2

ednotes

At last – Here it is, this lamentably late issue of Archive. Yet again, I say sorry for my sluggish state and will strive to speed up. The queue of finished articles continued to grow beyond what would fit in this issue, so the next one has a head start. The new DVD and CDs, archiving everything ever published in Archive up to the end of volume 22, will be ready to post with the next issue – order yours at the London show or see page 37.

Raspberry Pi on Newsnight – The tiny Raspberry Pi computer caught the fancy of BBC *Newsnight* just as Archive was going to press. It was in a 14-minute report about the sad level of "ICT" lessons in schools today compared to the heady days of the BBC Micro in the 1980s. *Newsnight* talked to the heads of Google and of Eidos games and to David Braben. The film is at *youtube.com/watch?v=rqqCoWa2FXg* and a blog and discussion are at *bbc.co.uk/news/technology-15240207*. (As ever, you'll find all these awkward URLs in clickable form on the Archive website, on the Links page.)

Cover and Christmas – Buses from Heathrow are heading for the London RISC OS show on October 29 – thanks again to Christopher Jarman for the cover graphic, in Artworks. Some of his past covers are available as Christmas cards: see page 33. —*jim*

• Archive was founded in 1987 in support of the Acorn Archimedes computer and its successors using the RISC OS operating system. It is entirely produced with RISC OS software. Body text is 9½pt Plantin; headings are EFF Eric (Gill Sans). Wordcount this issue: 26,686.

Lithoprinted by A2B Print Solutions, Somerset

Archive Editor: **Jim Nagel** *jim@archivemag.co.uk* Founding editor: Paul Beverley

SUBSCRIPTIONS – £50 in the UK for 12 issues, £56 to the rest of Europe, £62 to rest of the world

All the past 22 years on CD or DVD: p.37

Payment methods: *cheque to "Abbey Press" at address on back cover, or direct bank transfer with an email to confirm details – sortcode* **08-92-50** *(Co-op, Skelmersdale), account* **7072 6592** *(Abbey Press). Another route (less cost-effective) is via Google Checkout at www.archivemag.co.uk (Prices page).*

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- Spreadsheets to tell how fast that cannonball is falling – Gerald Fitton, page 38
- Examples of using accented letters in Datapower – Julian Fry – page 45
- Tests for aspect of GCC investigated by Rob Johnson – page 49
- Nicholas Cutler's Basic algorithms for the Fast Fourier Transform – page 55
- Jim Lesurf's apps to produce a sound and then test your stereo system – page 60
- **Cumulative Arcscan data: an index to your copies of Archive.**

These files are available free from our website at **archivemag.co.uk** *– click on "Files". If you are not online and would like the files on a floppy, contact the editor.*

Also: all the web links printed in this issue are on the website in clickable form.

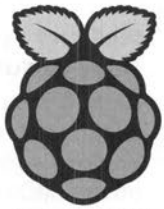
Newsbriefs Jim Nagel

£15 Arm computer to star at London show

David Braben's little baby, the sweetly named Raspberry Pi, will be on display in development form at the London RISC OS show on **October 29**. Because of it, the show is likely to attract a good number of punters from outside the RISC OS world.

The Raspberry Pi is an Arm11-powered computer packaged like a USB memory stick with a monitor port at the other end. The Python programming language and a version of Linux are built in. The device is soon to be on sale for just $25 – about £15. A Model B with ethernet and twice as much memory will be $35. The backers talk of worldwide release by December.

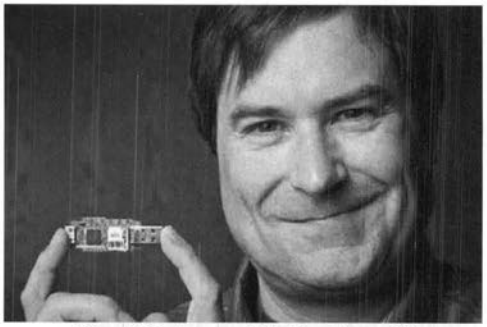
The idea of the non-profit Raspberry Pi Foundation (*raspberrypi.org*) set up by Braben is to inspire the next generation of bedroom coders in the same way that the BBC Micro did back in the 1980s – when schools taught computing principles, whereas today ICT lessons mainly train consumers to use the wares of Microsoft.



Winner of RPi's logo competition was revealed at press time. The design is like a 32-bit buckyball, implying π.

Braben, of course, is a name well known in Acorn circles as one of those bedroom coders: he and Ian Bell wrote *Elite*, the BBC Micro's most famous game, before he was 18. *Elite* came out in 1982. We have not yet heard the mature Braben's explanation for the name Raspberry Pi.

Will the finger-sized Pi be running RISC OS by the time of the London show? Bryan Hogan, one of the show organizers, said: "You will just have to turn up to find out."



David Braben and his Raspberry Pi

For another slice of Raspberry Pi news, see the New Arms column, page 12.

The London show, organized by Rougol (the RISC OS User Group of London), is in its third year at the same location: the St Giles Hotel, in Feltham, southwest London. The hotel is within sight of Feltham station, which is 30 minutes from Waterloo. It's very close to Heathrow airport: buses 285 and 490 run to Feltham every 10 minutes.

Maps, a full theatre programme and up-to-date show info are at *riscoslondonshow.co.uk*. Free tables for non-commercial developers are again on offer from the organizers. The show opens at 11am; door price is £5.

Armini gets OS upgrade and can dual-boot to Linux

An operating-system update and "Super Pack 1" went out to owners of R-Comp's little Armini machine in September.

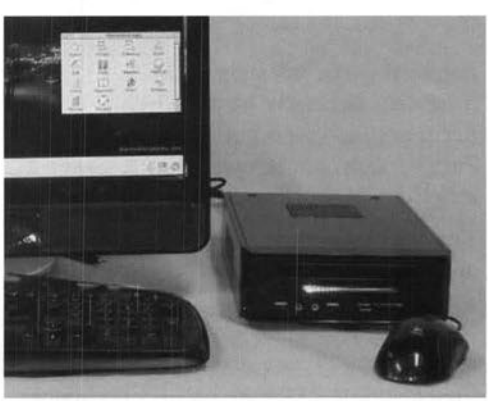
The OS upgrade provides smoother desktop action, has better support for USB devices, incorporates the new "filer action" window and resolves some minor issues with David Pilling apps, R-Comp said. Installation is a one-click procedure, and

users can roll back to older versions if need be. New Arminis will ship with the update pre-installed.

SP1, which comes along with the OS upgrade, contains about 12 megabytes of updated and additional components on disc: new programs, improved network drivers, hardware floating-point examples and CMos ram tools among them.

A separate development is that users can now run two operating systems on the Armini. A lightweight version of Ubuntu Linux optimized for the Arm Omap3 processor comes on a micro-SD card (*rcomp.co.uk*). Linux with an X Window desktop "remains quite a lethargic experience on Arm CPUs, especially compared to the slick performance of RISC OS, so we have done our best to optimize things," Andrew Rawnsley said.

R-Comp's £35 price is not for Linux (which is free) but for the special high-speed 8G card and postage and the hour needed to duplicate and set up each copy. The pack includes software such as Open Office, Gimp (photo manipulation) and the Firefox and Chromium browsers. Besides the Armini, the card suits other Beagleboard XM setups too.



Armini running RISC OS: "slick performance"

Google Custom Search
http://www.google.co
Google Custom Search requires JavaScript
JavaScript is either disabled or not supported by your browser. To use Custom Search, enable JavaScript by changing your browser options, then try again.
Google
Loading
Loading
©2010 Google
Done (1.1s)

It's a separate thing from the "Google ends support for old browsers" topic, but in late summer the Google search box in Netsurf's default home page began to require Javascript. Daniel Silverstone of the Netsurf team explained that the page used a custom search type that gathered microdonations from Google adverts to help support the Netsurf project. The team worked out a new method.

Netsurf reaches 2.8 as Google dumps old browsers

Netsurf 2.8 came out in September. The new version of the open-source RISC OS browser – and its incarnations for several other platforms – fixes bugs, adds support for frames and iframes and provides a new image cache that can make pages load faster. Download it free: *netsurf-browser.org*

Users willing to help the development effort can test-drive the latest builds appearing almost daily at the same site. Version r12975 came out just before this issue went to press with working "favicons", the miniature icons that appear in the URL bar to identify the website.

Meanwhile, Google has abandoned support for old browsers. The new policy is intended to spur users of Firefox 3.5, Safari 3, Microsoft Internet Explorer 7 and their forerunners to upgrade to newer and more secure versions if they want access to all functions of services such as Gmail,

Google Calendar and other online applications. The live graphic at *ie6countdown.com* says around 11% of the world still uses IE6, which is ten years old – in China the figure is 29%. And Firefox 3.5 still has 12 million users, although the current version (7) is better, faster, more secure and free.

Google's policy change was announced in June and came into effect on August 1. When each new version of a major browser comes out, Google will update its web services for it and then drop support for the version three before.

How does this affect RISC OS users? Gmail requires only cookies for its basic services, so it works fine with the Netsurf browser. Anything fancy requiring Javascript is out of reach anyway.

Google's policy "seems strange given all those cut-down versions [of browsers] used for mobile phones," opined one RISC OS user in a newsgroup.

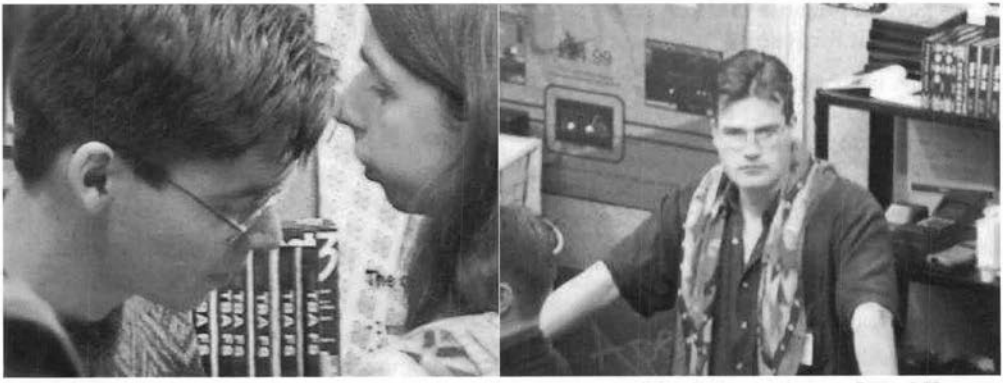
"They are not cut down," replied Andrew Hodgkinson of RISC OS Open Ltd: some modern smartphones have a Webkit engine more up to date than that in the main desktop browsers using it. "Most mid-range or higher smartphones and tablets have substantially better CPU and graphics performance than an Iyonix and usually more ram – 256M or more is common."

Ray Dawson posted the pithiest comment on Google's decision to bin old browsers: "I also understand that steam engines are no longer allowed on UK motorways."

TBA comes back home to help RISC OS Open

TBA Software, a big player in the Acorn games scene of the 1990s, has returned from exile – "enticed back by the project [ROOL] that has opened up RISC OS for everyone". Alan Peters popped up on the RISC OS Open forum in May with the surprise news that he and the other two in the original three-man team are back after 12 years away from RISC OS.

"I dug out the PRMs [programmer's reference manuals], fired up and upgraded



The younger Martin Piper (left), Alan Peters and Matt Dulson launching their racing game Brutal Horse Power on the TBA stand at Acorn World 1997 – a three-day show at Wembley. Martin's port of Quake, the big game of the day, starred on Acorn's own stand. (Photos by Gareth Moore, Acorn Gaming magazine)

TBA's other games include Cobalt Seed and Cyber Ape. Scenes from them all are included in a collection of classic Acorn games on Youtube – search for "peetvanpeebles".

the RiscPC, purchased a Beagleboard XM and got stuck into making all those nasty PC-mangling 26-bit instructions work in the 32-bit world," he wrote.

Within a week or so, they posted on their blog (*tbasoftware.co.uk*) that they had a running 32-bit version of their high-performance image filing system TBAFS (beta version can be downloaded) and were making progress on TAG, their 3D runtime engine. All of it is pure assembler, and they plan to open the source code to other developers.

"I still think there is room for RISC OS in an IT world dominated by Microsoft, Apple and Linux," Alan told Archive. "It makes for an interesting alternative for people when the other operating systems are all mature and – because of it – highly complex."

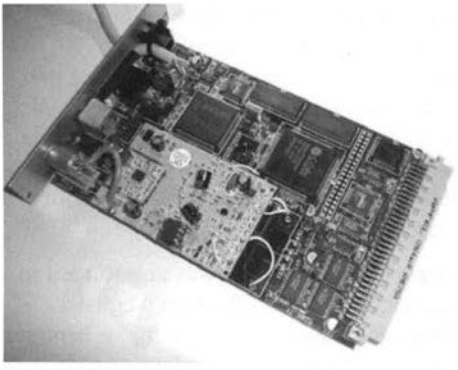
The 2011 reappearance has no official connection to the TBA business that the three friends wound up in 1999 "after having lost quite a lot of money", he said. "Indeed we are not foolish enough to return expecting to make money! It's a hobby that has restarted now that there is once again a purpose to doing some development for RISC OS."

But TBA is accepting monetary donations (independent of ROOL) to encourage its RISC OS development work. Keep an eye on the blog at *tbasoftware.co.uk*.

TBA began near Bath but today the three are based in Bristol, north Yorkshire and Singapore.

RiscTV podule morphs from analogue to digital

The RiscTV podule made by Irlam Instruments in the late 1990s has been brought into the age of digital broadcast. Robert Sprowson – better known just as Sprow – is offering to replace the obsolete



Prototype podule updated with DVB-T tuner

analogue tuner on the podule with a digital one, so you even resume watching telly in a window on your RiscPC or A5000 screen.

The cost is £55: he sends you postage-paid reusable packaging, you send your podule, he returns it upgraded, plus new desktop control software and a user guide and ten bob change from the £55. More details at *sprow.co.uk/pics/risctv.htm*

Irlam's podule cleverly uses hardware to mix the TV signal with the computer's graphic output – the TV signal does not go through the processor. Watching TV therefore does not slow down the desktop.

Spellings shifts servers to a more reliable farm

Purley Hosting, which holds many RISC OS users' websites, physically shifted all its servers to a new data centre on October 1.

All email and websites were shut down at 7am on the Saturday and were back in action by evening. Users were advised that it would take the rest of the weekend for the resulting new set of IP addresses to propagate around the internet, and that they may have to flush their DNS cache to access the new addresses. (Resetting the router usually does the trick.)

Neil Spellings, Purley's founder, said the move was due to "recent deterioration in the service from our current data centre that has resulted in a number of unplanned outages over the past few months". The new location, at Chelmsford, has much a better power supply and backup generators, he said.

Purley customers suffered major disruption for several days at the beginning of August. Frustration was rife in the newsgroups about how to contact Purley's support. The telephone number, 0844 772 0844, led only to voicemail – no status info. Purley's online support pages may have given another route, but that's a fat lot of use when the site is down. Finally someone in a newsgroup posted a link where ongoing status reports could be found on Twitter – but unfortunately gave it in a form that did not work in RISC OS browsers.

So, for future reference, Archive advises all customers of Purley Hosting to save two little one-line files, filetyped URL, that can simply be doubleclicked in case of a future outage.

Neil Spellings uses Twitter to keep web-hosting customers informed if his own servers are down. (Other than that, Archive is a Twitter-free zone and intends to remain so.)

```
http://downforeveryoneorjustme.com/
purleyhosting.com
```

As it says on the tin, that one checks whether the server really is down. You can amend it to check any other site that's giving you trouble. The second one, requiring no Javascript, is:

```
http://mobile.twitter.com/purleyhosting
```

Twitter, Neil explained, provides an ideal way to post quick status messages: staff can do it from a mobile phone while they are working, and it is transmitted via totally independent servers.

Apologizing to customers after service was restored in August, Neil explained that memory in one server had failed during a weekend and brought the whole system down. He also promised in future to keep the phone message updated.

• **Up time** – Another potentially useful site that an Archive member might like to try out and report on for next issue is *uptimerobot.com*. It pings a specified host every five minutes and keeps a log.

£300 challenge for USB audio system

A £300 prize is on offer to encourage development of new software that will enable RISC OS to use modern high-quality USB devices for playing and recording sound.

Jim Lesurf, who for many years has written articles on the subject of sound for Archive and specialist audio magazines, said he is offering the prize to attract interest in producing a specific useful item for RISC OS and possibly to attract new users. "This is not meant to be a full payment as if the project were a commercial commission," but winning the prize would bring public recognition, he said. Others could add to

the £300 if they wish. The problem, as he understands it, is that existing RISC OS USB stacks or interfaces do not support the "isochronous" and "asynchronous" methods used by modern devices such as the Halide Bridge and Arcam rDAC. He argues that a generic software method will be more "future-proof" than the dedicated sound hardware built into the RiscPC and Iyonix in the past.

"These days an increasing number of audio enthusiasts are turning to a computer for listening to music at home," he says. The USB devices he mentions deliver superb results when connected to a Linux machine. "RISC OS and its hardware should have advantages in this application area as they tend to be light, low-powered, compact and can be mechanically totally silent. The main blockage at present is simply being able to use modern USB sound devices from RISC OS."

The full text of Jim Lesurf's challenge is at *jcgl.orpheusweb.co.uk/ROAudioPrize.html* and also on the Archive website alongside his Sound files for this issue.

Pipedream goes freeware: download the latest version

No other spreadsheet for RISC OS has outlasted Pipedream, and the faithful workhorse has now been made freeware. The latest version (4.50/23, dated 2000 August) can be downloaded from *pipedream.abacusline.co.uk*.

Pipedream is an integrated spreadsheet and word-processor by Mark Colton. It first appeared as the main built-in application on the Sinclair Z88 tablet-sized computer in 1988. It was almost identical to Acornsoft's View Professional on the BBC Micro – because it's by the same author. The much more powerful Archimedes computer came out in 1987 and had Pipedream 2, single-tasking on the original Arthur OS. The multitasking Pipedream 3 for RISC OS followed.

Sinclair's ZX88 tablet in 1988 had Pipedream in rom as its wordprocessor and spreadsheet.

Mark Colton died in a motorsport accident in 1995, but others in Colton Software continued developing Pipedream, as well as its successor Fireworkz.

Abacus Training, Gerald Fitton's trading name, has handled sales and support for Colton's products since 1998 (except a single-tasking Pipedream for Dos, predating Windows – see *rakewell.com*). The move now to make Pipedream freeware is part of Gerald's "disengagement" from his responsibility for supporting the program, he said in announcing that Colton Software had given a green light for the release.

Though older, Pipedream has two advantages over Fireworkz, Gerald said. The main one is that every Pipedream operation has a keyboard shortcut; this enables command files to be built – what other platforms would call macros. The second is that Pipedream graphs can be customized to a greater extent than those of Fireworkz.

Where Fireworkz scores higher is display: it can use multiple fonts, sizes and colours, and it shows page boundaries unlike Pipedream. All versions of Fireworkz can load Pipedream files directly.

Pipedream's standard keystroke shortcuts feel quirky, since they were programmed before the wider world established "standard" keystrokes. However, Pipedream has a facility to redefine any key, and users have contributed command files that provide shortcuts considered less quirky (though command files by someone else might then not work).

Pipedream 4.50/23 is still a 26-bit program. It works on the Iyonix only under Aemulor. It will not work on other 32-bit machines such as the Beagleboard or Armini.

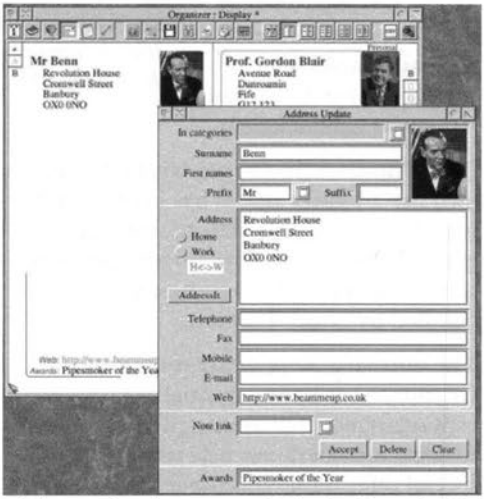
"It is unlikely that there will be anyone wanting to use Pipedream who hasn't got it already," Gerald said. "However, I am sure there will be many who have not bothered to upgrade to the most recent version. Now is your chance."

Asked whether the next logical step would be to release the source code of Pipedream to see if it would lead to further development, Gerald would say only: "It does raise the question ..."

(Fireworkz is an integration of Wordz, a word-processor, Resultz, a spreadsheet, and Recordz, a database manager, all from Colton Software. There is also a Windows version, file-compatible. When it was 32-bitted, the team decided to drop the database section and alter the name from Fireworkz Pro to Fireworkz32. Although revised files such as holiday dates were issued subsequently, the most recent version for RISC OS is 1.32/06 from 2002.)

Also free to download, from the same link, are the contents of all the floppy disks distributed every quarter through the support services that Gerald and his late wife Jill ran from 1990 onwards: Pipeline, Z-line and I-line, for Pipedream, Fireworkz and Impression respectively – combined in 1998 as Goldline, which closed only last year.

The files include examples of spreadsheets, command files, custom functions, form letters, databases and tutorials, many of them contributed by enthusiastic users. *[The late Francis Aries kept an index of the articles, but those published after his death need to be added. Perhaps an Archive member would like to volunteer. The necessary tools are already on the discs. Contact Gerald. —Ed.]*



A freestanding data-entry window in Organizer 2.1 makes it easier to input details to its addressbook.

Organizer deal for Archive members

Archive members using old versions of Organizer can upgrade to the latest Organizer 2 at the reduced price of £25 (normally £30) until mid-November.

Version 2 brought some major new features: a to-do section and the ability to exchange diary information in Ical format with similar software such as Google Calendar. Then 2.1 brought improvements to the addressbook section, where it's easier to add extra data such as job titles

and thumbnail pictures, and to the diary section, which now caters for public-holiday weekends, for instance. (Upgrade price from 2.0 to 2.1 is normally £20.)

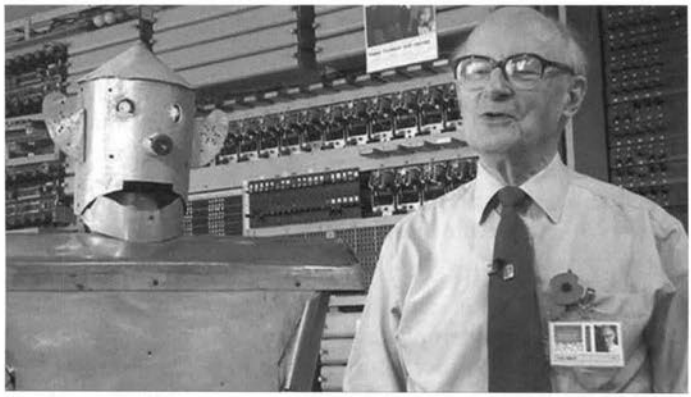
Armini and Beagleboard support was added in the current version, 2.12 (a free update from 2.1), which also lets you start the week on traditional Sunday instead of eurostyle Monday, a much requested enhancement.

Chris Morison first wrote Organizer for his own use 15 years ago. It has been the most popular RISC OS personal-information manager ever since. The current developer is Martin Avison; the business side is handled by Nigel Willmott.

The normal £30 upgrade route from Organizer 1 is online through *www.organizerpim.co.uk* using Paypal, but Archive members can take advantage of a special offer until November 15 by sending an email to *organizer@blueyonder.co.uk* quoting "special 2302" or post a £25 cheque to North One Communications Ltd, 38 Denton Road, London, N8 9NS, quoting the same code.

An old version, 1.31, can be downloaded free as a trial.

• **Windows and Mac** – Kevin Edwards is developing his own personal information manager for Windows and Mac because he misses the familiar Organizer layout from the Acorn world. He calls it In My Diary, and it's free to download (*inmydiary.co.uk*). So far it contains a diary, addressbook with label printing and a linked notes section.



Tony Sale in front of the rebuilt Colossus at Bletchley Park, with George V, the walking robot he built in 1950 with aluminium from a crashed bomber.

Colossus rebuilder dies after Queen's salute to Bletchley Park

Tony Sale, the visionary who started the campaign to save Bletchley Park for the nation and then rebuilt its legendary Colossus computer that cracked wartime codes, died at the end of August aged 80.

Rebuilding it was a hugely complex task because the original Colossus and its blueprints were destroyed to stop Cold War enemies from learning the codebreaking secrets. Sale and his team had only scraps of information to work with, and the project took them from 1993 until 2007. The reconstructed Colossus is now the centrepiece of the National Museum of Computing (*tnmoc.org*) at Bletchley Park.

Born in 1931, Tony Sale as a youngster showed remarkable aptitude for engineering and built his first robot, George I, from Meccano. By age 20 in the Royal Air Force he was lecturing on radar. He joined MI5 in 1957, becoming its principal scientific officer. Later he established several software companies.

During the Second World War 11,000 people served at Bletchley Park (near Milton Keynes) and its 300 "outstations"

around the world, decoding intercepted enemy messages on an industrial scale. Colossus, the world's first programmable electronic computer, and the electromechanical "Turing Bombe" were invented to help the task. By 1945 ten Colossus machines were operating.

The work was kept secret until the 1970s because of the Cold War – GCHQ at Cheltenham became Bletchley's successor. Bletchley Park fell into disrepair and in 1991 would have been demolished to make way for a supermarket but for an enthusiast who secured preservation orders on the park's trees. From there the Bletchley Park Trust grew. (*www.bletchleypark.org.uk*)

The Queen visited Bletchley Park in July to unveil a memorial to the wartime codebreakers. She met Tony Sale and specifically asked to see the rebuilt Colossus working.

Prosecutor abandons storm over Phorm

Nat Queen writes: BT and Phorm will not be prosecuted for alleged illegal interception of browsing data, the Crown Prosecution Service said this spring. But Alexander Hanff, who first filed a complaint in 2008, was in no mood to give up the fight: supported by other privacy experts, he said that he would consider applying for a judicial review of the CPS decision or complaining to the European Court of Human Rights – if he can find the funds. Stay tuned for further news.

In 2006 and 2007, BT and Phorm, a company based in the US, ran trials of technology that secretly scanned BT's customers' internet browsing for keywords to categorize their interests in order to produce more targeted advertising on websites (see my article in *Archive 22:4* for further details). Those secret trials were publicly revealed after the press gained access to internal BT documents in 2008. After campaigning by privacy activists, Phorm was effectively forced out of the UK market when BT, Virgin Media and Talktalk all abandoned plans to use Phorm's methods. *[The late Paul Vigay was one of these activists. —Ed.]*

In 2008, Hanff, a campaigner of Privacy International, filed a complaint to the City of London police, on the grounds that Phorm's covert monitoring software was effectively an illegal wiretap that breached the Regulation of Investigatory Powers Act 2000. When the police refused to investigate, Hanff applied to the Crown Prosecution Service for a private prosecution.

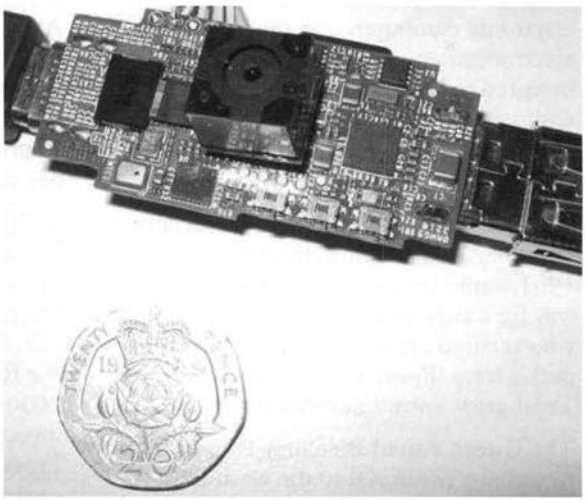
The CPS announcement in April said, "There is currently insufficient evidence to begin a prosecution." Moreover, "BT and Phorm received considerable legal advice" that the use of the scanning software was unlikely to be unlawful, and "as there was no evidence to suggest either company acted in bad faith, it could be reasonably argued that any offending was the result of an honest mistake or genuine misunderstanding of the law." The CPS concluded that "it would not be in the public interest to proceed any further". Full details of the CPS decision can be found at *blog.cps.gov.uk* (search for `Phorm`).

• **Amazon Silk** – The online retail behemoth Amazon unveiled a web proxy system in September, called Silk, that works in much the same way as Phorm's Webwise system. It aggregates private data and uses it to predict customers' behaviour and generate targeted ads. "Amazon Silk has the potential to make Webwise look like a tiff in a teacup," *The Register* said.

New Arms for Risc os

Trevor Johnson

With the arrival of R-Comp's Armini, we can now upgrade to new hardware running Risc os by buying everything from one place. We now have several Arm v7 devices capable of running our favourite OS – the Beagleboard and Armini, the IGEP (from a Barcelona company, *igep.es*) and the Touch Book among them. A few interesting developments just *might* make for future alternatives – read on.



The Raspberry Pi and a 20p coin to show scale. Its provisional design has a USB port on one end, an HDMI port on the other and an Arm11 processor in the middle. It also has 128M of ram, a memory-card slot and an HDMI video port. All for $25! In this photo, a 12-megapixel camera module is attached.

The $35 Model B (an allusion to the BBC Micro models?) is Beagleboard-size with on-board ethernet, 256M ram and an integrated hub giving two USB ports.

An Elite fruit Pi

David Braben – a familiar name from the days of the BBC Micro and early Archimedes as co-programmer of the classic game *Elite* – has come up with the Raspberry Pi, an unimaginably tiny computer in a package the size of a USB memory stick.

It is intended to stimulate the teaching of basic computer science in schools. It's designed around an Arm11 processor and should be on sale by year end for around £15 – no, that's not a typo. The Raspberry Pi Foundation (*raspberrypi.org*) is a charity, and David is understood to be pursuing this primarily as an altruistic project.

Theo Markettos said on the Risc os newsgroups that he knows a little more about the hardware: he works at University of Cambridge Computer Laboratory work in the next office to one of the Raspberry Pi charity's trustees. However, this information was not public knowledge until recently. We now know that the system-on-a-chip is a Broadcom BCM2835, using an Arm11 at 700MHz. While graphics acceleration is available, it requires proprietary code libraries. This means Risc os may not be able to utilize such acceleration.

In September the author of Aemulor, Adrian Lees, disclosed on the Rool forum that he works at Broadcom alongside Eben Upton, one of the Raspberry Pi trustees. "I'm just starting to look at the feasibility of porting Risc os to it, and Aemulor in due course. It's something we're keen to see happen so I should have no problems with support."

For Risc os, the Raspberry Pi may not encompass some of the potential hardware

benefits offered by the Beagleboard and Armini such as accessible graphics acceleration, but its price is very tempting for large-scale adoption. As they say, watch this space.

Smarttop

The Genesi Efika MX Smarttop now has a UK distributor. New IT Ltd, at Downham Market in Norfolk (*newit.co.uk*), sells the Smarttop for £115 including VAT.

The 250-gram machine runs an optimized version of Ubuntu Maverick Linux. When the hardware first appeared in the US last autumn Peter Naulls (the founder of *riscos.info*) called it "a credible target for a Risc os port".

Michael Grunditz – who works for Genesi – continues work on his personal project to port Risc os to the Genesi hardware after unfortunately spending some months in hospital. He has since received advice from Jeffrey Lee and Steve Revill regarding work with the Risc os source files.

Smaller and thinner than a DVD case and weighing only 8oz, the Smarttop is based around the IMX515 Arm Cortex A8 system-on-a-chip from Freescale. It has 512M of ram, an 8G internal solid-state disc, an SD card slot, USB, audio in and out, ethernet and wireless, a 3D graphics processor, multiformat HD video decoder and D1 video encoder and supports HDMI display.

Omniblockbusterosa

The Risc os user group of London in June was promised a play with a Beagleboard XM "running Risc os, Angstrom, Ubuntu, Android and ChromeOS – the last four simultaneously. I know this because it is in my bag," Brian Hogan, the Rougol chairman, posted in an Acorn newsgroup.

This was the Super-Jumbo from Always Innovating, the maker of the Touch Book. It's downloadable free from *alwaysinnovating.com/beagleboard*

A single image file (which needs 4G of ram to expand into) "aggregates hundreds of applications already set up for you across the four major Arm operating systems" – as the Always Innovating blurb puts it.

"Super-Jumbo has the unique feature to run those multiple operating systems at the same time, without any reboot, natively, and without any performance loss." It was first shown on April 13 at the Embeded Linux conference in San Fancisco. A demo is at *youtube.com/watch?v=yseT4USH8SY*

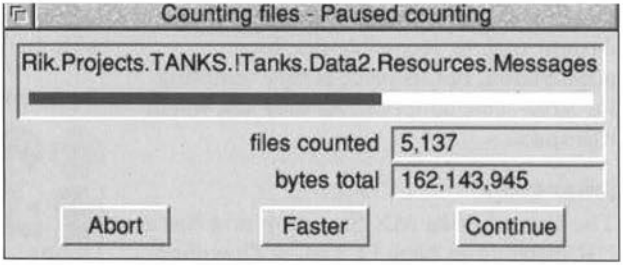
"If this initiative meets some success, the idea is to release a super-jumbo every quarter or so, with more OS and TI hardware support," said Grégoire Gentil, the founder of Always Innovating.

Other hardware

• The latest Beagleboard XM revision C has presented some issues for the Ubuntu Linux operating system, and these issues also look to be significant for Risc os. Jeffrey Lee published fixes in the Rool repository in mid-May to overcome some of the problems, and the others probably

won't be insumountable, so watch this space for an update.

• Rumours say that Apple may move to Arm processors for its laptops. If this happens, the consequences for Risc os are unknown: Apple, if true to form, will do all it can to prevent hackers from bolting alternative OSes onto its hardware.



Rik Griffin's new-look Filer Action panel in Risc os 5.17 has a progress bar.

• Check out the Hercules Ecafé: *riscosopen.org/forum/forums/9/topics/749*

Software progress

• Dave Higton previewed his new app to re-flash the SD and such cards on the Beagleboard. *davehigton@dsl.pipex.com*

• Rool's release of the software tools for the C and C++ languages is now at version 22, incorporating changes by Rool staff themselves. There is a discounted upgrade path for existing users.

• Jeffrey Lee has also been tirelessly working on modifications to the hardware abstraction layer (HAL). Issues include USB drivers, keyboard scan at boot, increasing the maximum video pixel rate to match the Armini, and better debugging functionality via the serial port. More detail at *riscosopen.org/viewer/revisions* and *riscosopen.org/forum/forums/3/topics/635*

• Rool's build of the IOMD rom (a key component of the RiscPC) now works more reliably with RPCEmu, thanks to Tom Walker and Jeffrey Lee (*riscosopen.org/forum/forums/5/topics/666*).

• Rik Griffin has done extensive work to enhance the Filer_action module, including a progress bar (*riscosopen.org/forum/forums/2/topics/636*). His code has now been committed to the Rool repository and is included in recent builds of the Risc os 5.17 beta.

• Alan Peters, one of the TBA Software crew who came back to Risc os a few months ago after long absence *[see Newsbriefs]*, had a headache adding VFP and SIMD functionality to the Basic assembler but made progress after shaking off a virus – of the biological rather than cybernetic sort: *riscosopen.org/forum/forums/5/topics/662*

Michael Kübel adapted his 2001 demo called Bilizo to use the Basic VFP/SIMD assembler. For any programmers wanting to make use of this facility in Basic, TBA Software includes documentation in its release.

• Rob Sprowson quietly fixed some bugs, among them an Arm v7 glitch in the Postscript driver. He has been analysing the proposed filing-system bounties in some detail – discussed at *riscosopen.org/forum/forums/8/topics/612*.

• A patch for Photodesk 3.10 fixes a snag with its Copy operations on the Armini and Beagleboard: *cjemicros.co.uk/photodesk*

Trevor Johnson *trevj@cwazy.co.uk*

Trevor has recently been losing the battle against becoming a Wikipediholic – see his other article on page 34. He lives in south Bristol and works as a civil engineer for a local authority.

Mac Matters

Mark Stephens

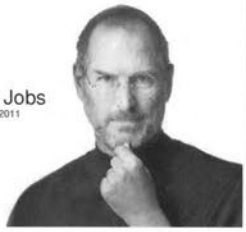
More adventures running Virtual Acorn on my Intel-powered Macbook Pro.

Lion news

VirtualRPC works fine on Lion, the latest version of OS X (version 10.7). I upgraded my Mac and tested it when it first came out.

And Tim Powys-Lybbe reports that so far for him, VirtualRPC runs as well as it does on Snow Leopard *[the previous version of MacOS]*. "Reunion on the Mac is OK, my second priority. But Messenger Pro on the Mac is showing some nasties on the configuration panels, though normal mail and news seem OK; we've immediately had an update from Mark Sawle – sterling support."

Goodbye, Steve



I was at a technology conference at the start of October in San Francisco. On the day Steve Jobs died, they stopped all events for a moment of silence as a mark of respect. Apple changed its website front page to a picture of him with a eulogy. Hundreds of tributes appeared outside the Apple store.

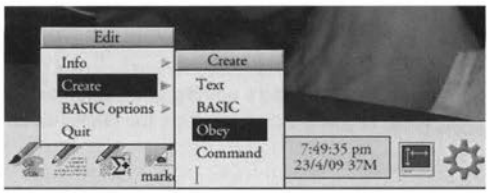
It is a rare talent who revolutionizes *one* industry, but he changed computing (with Apple), music (Ipod and Itunes) and film (Pixar) and his innovations are starting to change many other industries, such as ebooks. Steve Jobs was responsible for Apple Computers (creating it, getting the boot and then coming back to save it), the Mac, Ipod, Ipad, Itunes, *Toy Story*, *Finding Nemo* and many other films.

He made computer companies think about style and users again and he was also an inspiration to many in both business and technology. We will all miss him.

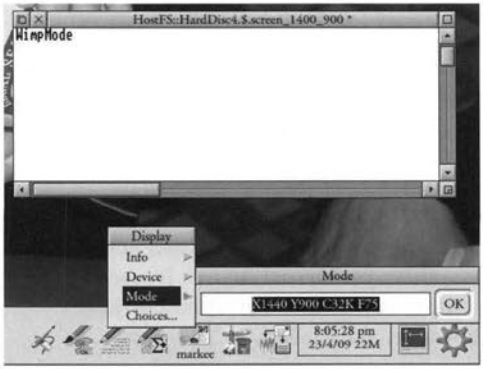
Screen modes

I usually run VirtualRPC in a little window and find it looks best at a particular screen resolution. This works fine, but if I switch to full screen, the display gets stretched and I need to choose a different screen mode. If I then plug my Mac laptop into my lovely external monitor, I get a huge screen and need to change things again. I can alter this by just clicking and changing the mode, but I find this fiddly and I am quite lazy. So here is my workaround.

Run !Edit and create a new obeyfile (screenshot 1). Give it a name like screen_1440_900. Open the obeyfile and type in the word `Wimpmode`.



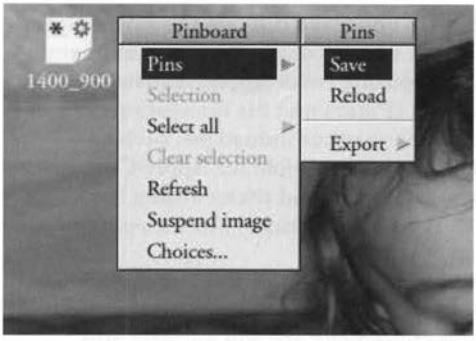
①



②

As shown in screenshot 2, use the Display icon near the right of the iconbar to change to the screen mode you want. Then from the menu choose Mode. You can then cut and paste this value into your obeyfile.

Save the file and put a link to it on your desktop (screenshot 3). Save it. Now you can switch screen modes with just two clicks. I actually renamed the file to 1400_900 so the full name displays correctly.



③

Welcome back, Iyonix

I have brought my Iyonix back out of the loft because often I had other tasks running on my Mac. As I have a switchbox there I can have multiple machines – I have a PC running Linux, a Mac (which also has Linux and Virtual Acorn on it) and my Iyonix. Having the Iyonix and Virtual Acorn prompted me to think about how I could better share data between machines (and an article for Archive).

It has been interesting to compare Iyonix and VirtualRPC. I never managed to get the scrollwheel or the Adjust button to work on VirtualRPC, so any hints are welcome. Comparing the appearance of the two, I personally still prefer the Iyonix iconset, so I have copied them across and use them on Virtual Acorn. It also gives me a more consistent feel when I switch between machines.

Organizer

When I set up my Iyonix in 2010, I found that every time I ran Organizer it crashed. Thanks to the excellent support of Martin Avison, we tracked this down to the fact that my clock was actually set to *2011*. Martin has promised that he will have this fixed sometime in the next 100 years so we will be able to carry on as normal!

Martin has been very busy releasing updates for Organizer (version 2.1, 2.11 and 2.12). He added some interesting new features, such as the ability to add pictures to addressbook entries. If you are still on a pre-2 version of Organizer, you are missing some nice new functions. In particular I like the additional views that let you see four or eight weeks ahead.

The software includes some routines to check that the application is installed without error. This did not work correctly on some Macs running Virtual Acorn (including mine). As you would expect, we quickly saw Organizer 2.11 released to deal with the issue.

Interesting rumours

Apple uses the Arm chip in its Iphone and Ipad, and there have been rumours it might switch to Arm in some laptops. Maybe one day we will be able to run RISC OS directly on the Mac – and it should fly? There are certainly lots of Arm devices appearing ...

Mark Stephens
markstephens@idrsolutions.com

You can glimpse Mark's daughter hiding in some of the screenshots. She is 10 now, but Mark says he really loves the picture and it's nothing to do with having forgotten how to change the background.

Free to share: PD column

Steve Fryatt

Regular readers will know I'm a fan of Superdoku, the desktop sudoku game by Sine Nomine's Hilary Phillips – this column covered it a number of times since its release back in 2006. At the Wakefield show in April it was joined by a sibling: **Wrangler** is a suite of mathematical puzzles that are linked mostly by *not* conforming to the sudoku template.

Anyone who has used Superdoku should immediately be at home with Wrangler: it follows the same basic style, and user interaction occurs in a similar way. As with the original game, the presentation is slick and the interface is friendly and intuitive.

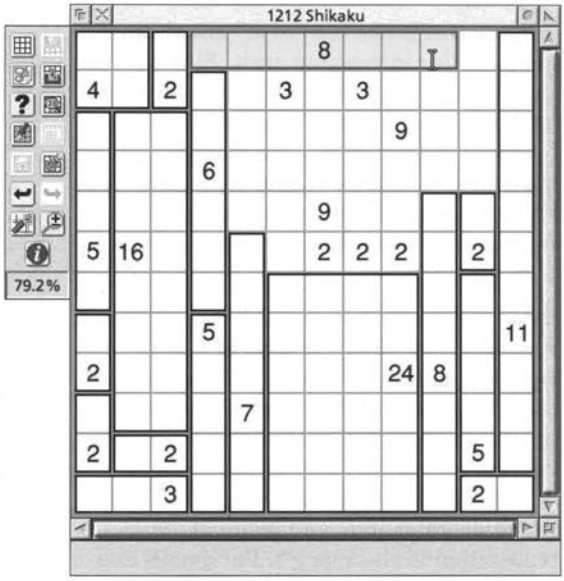
It includes three types of puzzle:

• Kakuro puzzles are arithmetic crosswords: the grid consists of groups of cells that must add up to specified totals. Each cell must contain one of the digits 1 to 9, and in any given row the same digit can not be used more than once – these constraints are what allow the puzzles to be solved.

• Cross-sums consist of six interlocking sums, each with three numbers, two operators (from +, −, × and ÷) and an answer. The task is to find and fill in the correct numbers to make all of the sums (simultaneous equations, for the mathematicians) come out to the correct values.

• The third game is Shikaku. A square grid contains a smattering of numbers, and the task is to draw rectangular boxes so that each box contains exactly one number and consists of exactly that many cells. This is very different from the other two games *and may well make Wrangler a "must have"* even if you don't "get" the mathematical nature of kakuro and cross-sums.

As with Superdoku, all the games contain a hint facility and an analyser that can display the options for all the empty cells;



Solving a shikaku puzzle in Wrangler: fill the grid with rectangles to enclose all the numbers.

where relevant, there's also a built-in "notepad" to let you elimate values as you go without the need for a pencil and paper. A solver will finish off any missing values if you get stuck (or, with an Adjust-click, complete just one step for a bit of a nudge), and alongside the puzzle generator there's an editor that allows grids to be copied from newspapers and magazines or created from scratch. Puzzles can be saved for completion later or exported as drawfiles.

Wrangler is shareware: the website contains a functional demo with limited use, and registration costs £5 by cheque or Paypal (online credit card).

Sudoku addicts will be pleased to know that **Superdoku** has also seen some updates. It can now play Hitoshii (or Kenken) puzzles, which contain arithmetic constraints in addition to the normal sudoku logic. There's also a new "quadruplet" board shape for some puzzles: this is like the "twin" board but contains *four* interacting grids. Finally, there's a new "twist" block style, where the grid contains an extra "twisted block" overlaid on the others – the manual explains it well. Like Wrangler, SuperDoku is shareware and costs £5 to register (registered users can update to version 1.26 for free).

And fans of patience games have not been forgotten, as Hilary's **House of Cards** suite has gained a "save game" facility and become fully Beagleboard-friendly (as are the numbers games). Like Superdoku, I've covered House of Cards in this column before. The fully playable demo is well worth downloading, and if you like it registration is also just £5. For details and downloads of all three titles, visit *sinenomine.co.uk/software*

Postscript manipulation

The use of Postscript files as part of the printing process has become better known recently due to their involvement with the creation of PDFs and the arrival of the PS3 printer-driver from John Tytgat and Martin Würthner. Postscript's use for commercial printing and other high-end applications has been around much longer, however, and as a result a surprising number of utilities exist to manipulate the PS files.

Angus Duggan's **PSUtils**, originally written for the Unix platform, are a case in point. Graham Jones brought them to RISC OS and gave them a desktop interface in the late 1990s. Unfortunately that was where they remained, until a recent discussion on the RISC OS Postscript mailinglist prompted Chris Gransden to re-port the latest version of the Unix command-line utilities at the heart of the program and make them both 32-bit and Beagleboard-compatible at the same time.

[I contacted Graham Jones (in Oxfordshire), who replied: "I originally ported Ghostscript some years ago, which Martin Würthner updated more recently, and I also ported PSUtils around the same time. I am not the Graham Jones who lived in Scotland and did Sleuth and Sharpeye (the OCR applications that turn scanned text and music into editable files). There seem to be quite a few of us around." —Ed.]

Once installed on the iconbar, PSUtils provides access to six different functions – click Adjust on the iconbar to change function. Each can be configured via its own dialogue box, and Postscript files can be dragged to the icon for processing and re-saving under another name. Some of the utilities duplicate functions that are provided in the print dialogue boxes of certain applications, but because they act on the output of the printing system they are available even when using less capable software.

PStoPS and **PSselect** allow the pages of a document to be reordered or removed. The syntax of PSselect is easier: it accepts phrases like "all odd", "all even" or custom ranges in a comma-separated list (such as "1-3,5,7-9"); the result can also be output in reverse order if required. PStoPS is more powerful – not to mention complex –

and allows documents to be broken up and rearranged in many different ways for printing or collating booklets or pamphlets. Perhaps fortunately, the remaining PSUtils offer some of these functions in easier ways.

PSnUp takes a document and rearranges the pages so that several can be printed on the same side of a sheet of paper. *[Placing or "imposing" eight pages on a single side of a large sheet is called "eight-up" in printshop jargon. —Ed.]* Paper size, orientation, margins, outlines and scaling can all be specified. **PSbook** rearranges a document's pages into the correct order for booklet printing, and **PSresize** scales and centres a document to fit on a

hint&tip Impression pamphlet and a duplex printer

One of these Postscript utilities provides a missing link for users of good old Impression who have a newfangled duplex printer. (This topic was discussed in *Archive 21:6*, where Ian Harding used Ghostscript and a purpose-made application called !Pagecut.)

The problem concerns duplex-printing a *multi*-sheet *pamphlet*. (A *single* sheet is trivial.)

By *pamphlet* we mean a document with more than one page on each side of paper – two pages of A5 on one side of A4 like this 64-page issue of Archive, for example. The first side of the first sheet (call it 1A) has pages 64 and 1, and on the back of the sheet (call it 1B) are pages 2 and 63; the second sheet (2A) has pages 62 and 3 backed (2B) with 4 and 61; and so on until the centre sheet, which is 34 and 31 (being 16A) backed with 32 and 33 (16B). Thinking about how the sheets are going to be folded, you could use the terms *out-side* and *in-side* for A and B.

A *duplex* printer is one that prints the front of a sheet, then flips it over with some clever internal machinery and immediately prints the back. So it expects files to be sent to it in the order 1A, 1B, 2A, 2B, ... 16A, 16B.

Problem is that Impression predates affordable duplex printers. It prints all the out-sides, then asks you to turn the whole stack of paper over, then prints all the in-sides. In other words, it gives you 1A, 2A, 3A, ... 16A, turn stack over, then 16B, 15B, ... 2B, 1B.

Hooray, the PSselect utility rides to the rescue! A one-line command shuffles Impression's order into duplex order: `*psselect -q -pl,_1,2,_2,3,_3,4,_4 Printout PrintoutD4`

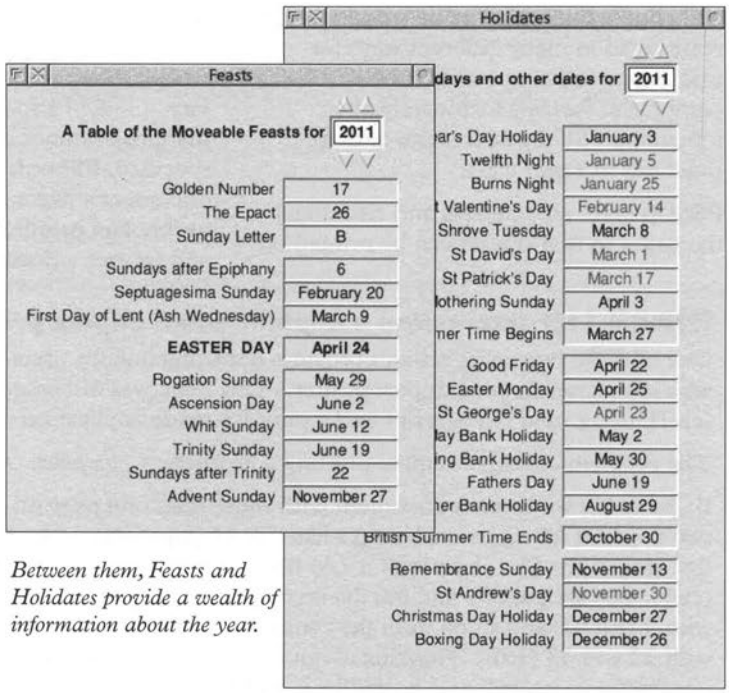
This assumes Impression has printed to a file called `Printout`. Shift-click !Printers on the iconbar to find the folder containing that file, and from the filer menu make it the "work directory" or "currently selected directory" (or do this with a `*dir` line before the command) – then you don't have to give a full pathname in the PSselect command. The duplexified output file, `PrintoutD4`, will appear in that same directory.

The `-q` suppresses the page number that the utility would normally add to each page it outputs. The `-p` introduces a list of page numbers, which in this context means the order of our "sides" as they appear in Impression's file. Conveniently, PSselect uses the prefix "_" (underscore) to mean count from the *end* of the file, so the syntax of the command is exceedingly simple. The example command is for a four-sheet pamphlet.

Jim Nagel *jim@archivemag.co.uk*

different paper size.

The final utility, **EPSfit**, is a little different in that it takes an EPS file (such as those exported from the Postscript option in Draw) and fits it into a bounding box on the page. This makes it easier to handle the file as "normal" Postscript for subsequent processing in PSUtils or elsewhere.


Feasts
A Table of the Moveable Feasts for 2011
Golden Number 17
The Epact 26
Sunday Letter B
Sundays after Epiphany 6
Septuagesima Sunday February 20
First Day of Lent (Ash Wednesday) March 9
EASTER DAY April 24
Rogation Sunday May 29
Ascension Day June 2
Whit Sunday June 12
Trinity Sunday June 19
Sundays after Trinity 22
Advent Sunday November 27
Holidates
days and other dates for 2011
ar's Day Holiday January 3
Twelfth Night January 5
Burns Night January 25
t Valentine's Day February 14
Shrove Tuesday March 8
St David's Day March 1
St Patrick's Day March 17
lothering Sunday April 3
ner Time Begins March 27
Good Friday April 22
Easter Monday April 25
St George's Day April 23
lay Bank Holiday May 2
ing Bank Holiday May 30
Fathers Day June 19
ner Bank Holiday August 29
British Summer Time Ends October 30
Remembrance Sunday November 13
St Andrew's Day November 30
Christmas Day Holiday December 27
Boxing Day Holiday December 26

Between them, Feasts and Holidates provide a wealth of information about the year.

Some of the options provided by PSUtils are quite specialized, but they provide a number of useful tools that can perform quite powerful operations. To get hold of a copy, download the 26-bit version 1.16 from *acornusers.org/ghostscript* and then merge in the 32-bit update from *www.cgransden.co.uk/psutils_1.17-1.zip* to get version 1.17.

High days

My harddisc seems to be full of small utilities that see regular use without ever getting a second thought. Two such are Rex Palmer's **Feasts** and **Holidates**, which between them provide a range of useful dates for the diary. It displays details on screen in a small window, which you can print out if you need them in a less ephemeral form.

Holidates produces a table of public holidays and other dates for any year from 1978 onwards (before then, the legislation governing things like bank holidays and summer time differed enough to make the results unhelpful). In addition, the list includes dates connected with Christmas and Easter, the common saints' days and those such as Remembrance Sunday, Mothering Sunday, Father's Day and Burns Night.

Feasts, in contrast, tracks the movable Christian religious feasts: in particular the dates surrounding Easter and Advent. Besides the actual dates, the table includes annual constants such as the year's golden number, Sunday letter and epact as used by the original date calculations – Rex's informative helpfile has more information, and Googling "Computus" should produce further reading. Unlike Holidates, Feasts can calculate dates back to the year 325 – when the Council of Nicaea first agreed on how to derive the date of Easter Sunday – and correctly handles the move from the Julian to Gregorian calendar at

various common points.

The prompt to revisit the two utilities came when an update to Holidates fixed an obscure bug that apparently shows up once every 28 years: the Western calendar contains many pitfalls for an unwary programmer, and in this particular case Rex's algorithm miscalculated the New Year bank holiday in leap years starting on a Sunday. Version 1.06 fixes this, in plenty of time for the arrival of 2012.

Another useful download from Rex's website are his **Taxcalc** spreadsheets designed in Fireworkz. They are based on the HM Revenue & Customs Tax Calculation Guides and the Standard and Short Tax Return forms and have been updated to suit the 2011 paperwork. For more information, see my review on the 2010 sheets back in *Archive 22:10* and Rex's own article in the same issue.

All of Rex's software is freeware, and the latest versions can be downloaded from his website at *arisc.co.uk*

Desktop enhancers

Over the years a wide range of application-launchers and desktop aids have come out for RISC OS. Which – if any – one chooses seems to be a very personal matter. One that gets discussed frequently is Guttorm Vik's **Strongmen**, so when Fred Graute announced the recent updates I was a little surprised to find that the only mention it's ever had in the PD column was a couple of lines in passing back in 2003.

Like a number of its "competitors", Strongmen provides a set of customizable menus that can carry out a range of actions. If it is configured to appear on the iconbar (optionally at the extreme left), then a Select-click on that icon will open the full menu. A click with Select, Adjust or Menu at the far left of the screen is also intercepted and can open different parts of the whole menu (if Strongmen claims them, the clicks do not affect any windows underneath).

Menu entries can launch applications and files or run *-commands, and the whole thing can be arranged hierarchically into menus and submenus. Keystrokes can also be defined to carry out specific actions, and these can include keys on the numeric keypad. In addition, Strongmen has extra commands of its own that can launch URLs into a web-browser and type text at the caret.

Coolswitch makes it easy to find those missing windows on the desktop.

In addition to the "static" menu, Strongmen can also build its own. Parts of the tree can contain lists of recently opened files, which can be grouped by type if required (the example menu has groups such as Last Basic files, Last C sources and Last images). There's the option to include a list of open files, where (in a similar vein to other "open file" utilities) selecting one will *close* it – take care! There's also a URL hotlist, which can spot sites being added to the hotlists in Fresco, Browse or Netsurf. A handy utility is included for creating temporary directories on disc – a bit like a manual Transient.

With version 1.26, Fred has made Strongmen fully 32-bit and Beagleboard-compatible, and he fixed a bug with the history menu. There's also improved hotlist support, with the inclusion of

Netsurf and use of the Acorn URI system to launch sites, and some other housekeeping. Strongmen is freeware; downloaded it from *stronged.iconbar.com/fjg*.

[Fred Graute also maintains other applications originally by Guttorm Vik: the text editor StrongEd and Stronghelp. I have only just twigged that the "men" in Strongmen comes from "menu". —Ed.]

Another desktop enhancement that recently made the jump from 26-bit-only to (hopefully) Cortex-A8 compatibility all at once is Andy Armstrong's **Coolswitch** module, thanks to an update by Frank de Bruijn.

It provides the Alt-Tab and Ctrl-Tab functions from Windows on the RISC OS desktop, making it possible to cycle quickly through all the open windows using the keyboard and bring them to the top of the pile in turn. Alt-Tab cycles through all the windows grouped by application (so all the Ovation Pro windows might come to the top, then all the Netsurf windows, then all the Zap windows, and so on); Ctrl-Tab cycles through all of the windows belonging to the application whose window is currently at the top of the pile.

Using either combination of keys opens up a small pane in the centre of the screen listing the available windows or groups of windows, and highlighting the one currently uppermost – very similar to the way that older versions of Windows operated. Although there are several RISC OS implementations of the concept, Andy's was the one that I preferred until I went 32-bit, and for eight years I failed to find a replacement that I could get on with. With Andy's blessing, Frank's updated version (renumbered 1.06) can be found under a freeware licence at *aconet.org/tools*

Beagle-friendly

• Following a bug report on the newsgroups, Chris Johnson released an update to **Unitconv** – his handy utility for converting numerical units. It deals with length and distance, area, volume, weight, pressure, velocity, time, power, energy, temperature and fuel cost or consumption. There is also support for chemists and physicists with chemical energy calculations and gas collisions. Desktop publishers have an invaluable calculator for image size, scaling and resolution. There's also a window to convert number bases. Version 2.25 resolves the aforementioned bug and also makes Unitconv Beagleboard-compatible – it can be found at *chris-johnson.org.uk/software/unitconv.html*

• Back in March, David Ruck announced updates to many of his own titles, although he stressed that he hadn't been able to test any on a Beagleboard. Included were **Workspace**, which gives you six colour-coded desktops, and **Graphtask**, which provides graphical taskwindows. Several developer tools were also updated, including the invaluable **Armalyser**. For more details, see *armclub.org.uk/free*

Steve Fryatt *steve@stevefryatt.org.uk*

Steve was busy with two back-to-back productions at the theatre as he wrote this: from the 17th-century bawdiness of William Wycherley's *The Country Wife* (too outrageous to be performed between 1753 and 1924) to the present-day tale of Tessa and her colleagues in a Bournemouth brothel. "What goes around ..." etc.

The cookie crumbles

Nat Queen

At one minute past midnight on May 26 a new law governing the way cookies may be used by websites came into force in the United Kingdom.

If you pay any attention to cookies, as I do (I am constantly deleting cookies during and after my browsing sessions), you will find that in practice cookies are used by the websites of practically all organizations – those of government departments, newspapers, broadcasters, universities, banks, retailers, for example.

The law now requires that all UK organizations running websites must obtain visitors' consent before creating cookies in the users' computers. Nevertheless, at the time of writing (a full month after the new law became effective), I could find hardly any websites asking visitors if they consent to cookies being created on their mVachine. What's going on?

The new law has not been well publicized, and organizations responsible for UK websites have not been prepared to implement the necessary changes. Just before the new rules came into force, the British government announced that website owners "are being given up to 12 months to 'get their house in order' before enforcement of the new EU cookies law begins". This decision was explained in a news release (*bit.ly/iX4glY*, a PDF) on the website of the Information Commissioner's Office (ICO), dated May 25 – the day before the new law became effective!

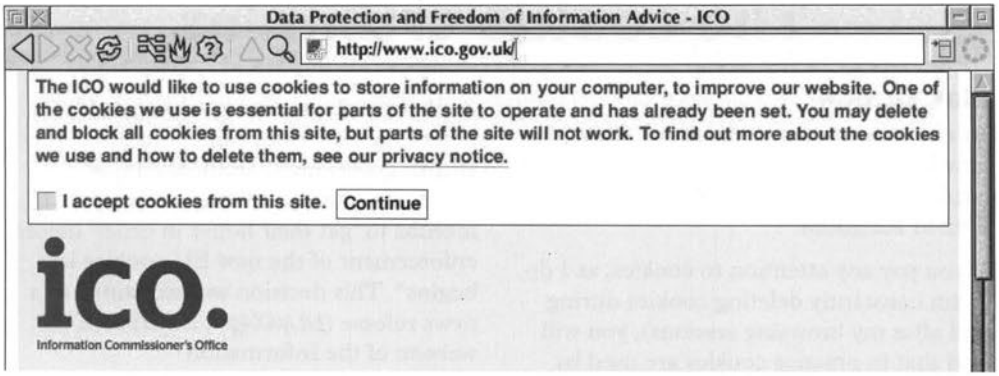
What's a cookie anyway? The word comes from Dutch *koekje*, a little *koek* (cake). In North America it's what most of the English-speaking world calls a biscuit. 'Tis said a Scottish cookie is a small, plain bun and a South African cookie is a cupcake (recipes, anyone?)

An HTTP cookie, however, was first called a "magic cookie", a data packet that a program receives and resends unchanged. A coder named Lou Montulli working for Netscape in 1994 had the bright idea of using them to implement an online shopping system. Privacy worries began when the public first heard of them from a *Financial Times* article in 1996.

Some history

The problem can be traced back to an European Union directive in 2002 concerning the processing of personal data and the protection of privacy in electronic communications, whose full text is at *http://bit.ly/wLKbh* (warning: this is not an easy read!). The provisions of that directive were implemented in UK law in 2003 in the form of revised Privacy and Electronic Communications Regulations.

The law required, in particular, that website users must be given clear information about the purposes of any cookies, and must be given the opportunity to refuse them. Many websites explain their use of cookies somewhere in the small print, for example, on a page stating their privacy policy, and this was deemed acceptable practice. Since most web-


Data Protection and Freedom of Information Advice - ICO
http://www.ico.gov.uk/
The ICO would like to use cookies to store information on your computer, to improve our website. One of the cookies we use is essential for parts of the site to operate and has already been set. You may delete and block all cookies from this site, but parts of the site will not work. To find out more about the cookies we use and how to delete them, see our privacy notice.
I accept cookies from this site.
Continue
ico.
Information Commissioner's Office

To set an example, the Information Commissioner adds a cookie bar to the top of every page on his website.

browsers have a configuration option to accept or refuse cookies (but usually set to accept them by default), it was generally thought that this amounts to compliance with the law, even though many users may not even be aware of such an option or of the existence of the cookies themselves.

What has changed?

In 2009, revised EU regulations require website owners to obtain informed consent from web users before tracking cookies are installed on their machines. This is what the new UK law is intended to implement.

The only exception occurs when cookies are "strictly necessary" for providing a service "explicitly requested" by the user. For example, a website from which the user can order goods or book tickets must "remember" what has been ordered each time an item is "added to basket", possibly from different web pages, until the user "proceeds to checkout", and this is usually implemented by means of cookies. Consent is not required for such activity.

The implications

It is unclear exactly what website owners will now be expected to do. Apparently it will no longer be sufficient to assume that if a user's browser is configured to accept cookies, this amounts to consent.

In the news release on the ICO website mentioned above, the Information Commissioner states: "It would obviously ruin some users' browsing experience if they needed to negotiate endless popups – and I am not saying that businesses have to go down that road. Equally, I have to remember that this law has been brought in to give consumers more choice about what companies know about them. That's why I'm taking a common-sense approach that takes both views into account."

But how can this dilemma be resolved? The news release states: "Browser settings giving individuals more control over cookies will be an important contributor to a solution. But the necessary changes to the technology aren't there yet." It was announced that therefore the ICO will not enforce the new rules for 12 months. It's not obvious to me what "changes to the technology" the Information Commissioner envisages. It also seems to me unrealistic to expect that all users will upgrade their browsers to implement some new functionality.

Meanwhile the Information Commissioner

states: "My own website will be looked at for a model of how to comply." He points out that the ICO website (*ico.gov.uk*) now contains a header bar with information about how cookies are used and how to manage them, but that other websites need not necessarily do the same. It is promised that the initial advice "will continue to be supplemented with real-life examples as they come in".

Bother and confusion

When viewing British websites in the future, will we be plagued by endless notices, annoying popup windows, forms asking for consent, and so on, or will there be a more user-friendly solution? It might not be so bad when navigating one particular website – once you accept its cookies, you probably won't be bothered again. But if you browse through ten retailers to find the best price for an item, this could become a little nightmare.

Of course, the user's browser may be configured to block popups by default, but for this reason popups may not be considered an acceptable method of seeking consent. It also seems impractical to configure the browser to block cookies by default, because some websites do not work properly without cookies.

There is some confusion at present over how the latest EU regulations can be implemented in practice, and it remains to be seen how our browsing experience will be affected. It is interesting to note that the new requirements have so far been implemented into the national laws of very few of the 27 EU member states or have so far been implemented only partially.

Nat Queen *n.m.queen@bham.ac.uk*

Nat and his wife joined the National Trust a few months ago after visiting several of its wonderful sites, and summeri, when he has more free time from his work at Birmingham University, was a time to visit many more.

Quacking private searcher

Extra privacy features are offered by an alternative search engine with a kooky name: Duck Duck Go. It promises "way more instant answers, way less spam and real privacy". It works well with the Netsurf browser on RISC OS. *duckduckgo.com* or (shorter) *ddg.gg*

Unlike Google, it keeps no record of your IP address, your browser version or the terms you entered in the search field. If you click on a result, "The other sites will still know that you visited them, but they will not know what search you entered beforehand," says Gabriel Weinberg in Pennsylvania, the one-man coder. He took the name from a playground game, *Duck, Duck, Goose*.

The home page links to an illustrated guide about what other browsers reveal.

"!Bang-commands" (what we call !pling) directly search another site: `!w riscos` goes to Wikipedia, for example. —*Ed.*

Wakefield 2011

Ron Briscoe

Photos mostly by Colin Sutton (CS)

Nice day for a nice show. Jim being desperate and me being in the vicinity, he asked me to write about this year's Wakefield Show on April 16 and so you know what to expect. Yes, absolute drivel.

The day started with Doug Webb driving us to the venue – the familiar Cedar Court Hotel at M1 junction 39 – and, despite missing the turnoff, getting to the show before the start time. Doug feeling peckish, we drove to a small cafe not far from the hotel where Doug partook of a "small breakfast" and I a black coffee. What we hadn't realized was that "small breakfast" was a Yorkshire version of small, that is, a huge plate overloaded with food*.

Club business

Back at the show two of my fellow Wrocc members (Wakefield Risc os Computer Club) took our entrance fee and, exchanging pleasantries, issued us with our admission tickets. I noticed that unlike the ones I produced for the Mug show last summer (gory details in *Archive 22:10*), Wakefield's were of a uniform colour. Once inside, Doug and I split up and went our separate ways till lunch.

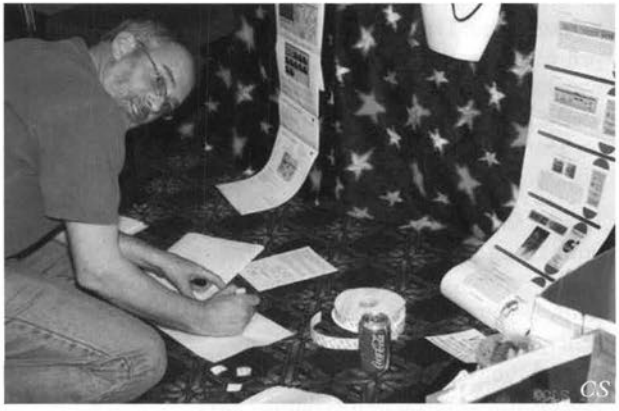
My first port of call was the Wrocc stall, where I renewed my membership successfully despite their pretending that the membership forms had been mislaid. Money was also exchanged for the club's back-catalogue CD and *The Wrocc Guide to Networking* part two.

Mind you, I still can't find the "Who you know, not what you know" section. (See *wrocc.org.uk* for how to order these.)

Charity first

Deciding to visit the charity stall before all the best bargains are snaffled, an amazing display of old Acorn computers greets mine eyes. They are so numerous that I at first think that either I have stepped into the Tardis-like stockroom at CJE Micros or Retro Software has taken over the charity stand. Looking at the serried ranks of old machines I wonder just how many are being replaced by the Armini – and judging by the press of bodies at the R-Comp stand, quite a few.

Pausing to pick up my latest copy of Archive and talk at the old and new editors, I get asked by Jim to write this article. This shows how desperate Jim is to get decent copy to fill the magazine. Fat chance if he has to print my stuff. Feeling sorry for him, I promise to send him a



After his all-night session finishing the user guide for Flicker IV, his new software for presentations (don't mention Powerpoint), Martin Hansen was caught by the camera frantically setting up his Mathemagical stand in time for the first showcomers.

cheque for my magazine renewal. It's only fair after planning to subject a man of his delicate sensibilities to editing this tosh.

Right next to the Archive stand is something new called Wiki Project RISC OS manned by Trevor (the link) Johnson. Trevor gives me a leaflet explaining what the project is all about and how everyone can help to promote RISC OS in Wikipedia. He is such a nice man I refrain from telling him that my help is considered more of an hindrance. Those who can help more than I, meaning all of you, are invited to visit *en.wikipedia.org/wiki/Wikipedia:WikiProject_RISC_OS* [see Trevor's article on page 34.]

Retracing my steps and passing the already crowded Steve Fryatt and Netsurf stands, I visit the estimable Martin Würthner and remark that this is the first year that I am not able to purchase an Artworks upgrade. Martin, pointing to one of the posters on his stand, informs me that he indeed has a new upgrade to purchase, finished only the previous evening. Money changes hands and I exit bearing my little card with my password for the Artworks 2.XI download. *[Its main new feature is a style editor: a consistent set of styles can be applied to an object with a single click. —Ed.]*

Paul Stewart, editor of Drag'n'Drop, had a new issue ready to download a few days after the show. It sells as PDF at £3 an issue, not by subscription.

Wakefield's charity stand was, as ever, a treasure trove. Over the years donated items have raised £15,000 to help the local hospice. (Photo by ROOL)

I then make a beeline (i.e., wander all over the place) for the Organizer stand and purchase the long-awaited upgrade to Organizer2, full of all sorts of new useful features and worth every penny that I pay. I have seen posts asking whether there is an equivalent application for Windows. If in the unlikely event there is, it will cost a packet and probably pass on all your addresses to spammers, so be warned.

Drop it, dragged off for lunch

Pausing to exchange a few pleasantries with Paul Stewart and hearing that he is at the moment short of sufficient funds to buy an Armini due to large and unforeseen demands on his bank account, I decide to keep him waiting for the measly £3 he wants for the new issue of *Drag'n'Drop*.

Hearing my name called, I turn to see three of my fellow Mugs, Stuart, Graham and Vic. Graham is carrying a box containing his new Armini. Vic informs me that he is an early adopter of the Armini, and Stuart is thinking of getting one.

We are soon joined by two more Mug members, John and Stephen. They have all been looking for me and Doug because it is lunch time and the Navigation Inn beckons, a quarter-mile up the road and across the canal. "Doug is at a presentation," I say and, like a genie proving me a teller of falsehoods, up pops Dougie. I give Paul Stewart the dosh for my copy of *Drag'n'Drop* and off we go.

After lunch Vic gets his Armini along with a suitable monitor and goes off to play with his new possessions. Vic knew it was a suitable monitor because it were the one R-Comp had been using to show off the Armini.

In the meantime I visit the Rool stand and purchase an upgrade CD for the C-and-C++ development suite and a Rool CD, getting a Bounty bar in return. Deciding to leave the Rool mug till later, having

Steve Fryatt – progammer of Cashbook and PrintPDF, maintainer of our Netsurf frontend and editor of the Wakefield club newsletter.

Rool had a bounty for our man from Mug. The eponymous chocolate was advertising the scheme where people donate money to encourage people with coding skills to work on specific parts of Risc os 5.

spotted that the R-Comp stand is reasonably quiet for now, I meander on down.

From R-Comp I purchase an upgrade to Safestore2 and yet again fill in the R-Comp clipboard with my address details. A dark thought along the lines of "How can a company selling both hardware and software have to rely on paper and pencil for data collection?" passes through my mind. It is reinforced by one of the two clipboards being mislaid temporarily. I also note that the pencil is firmly attached to the board with strong string.

I spend a few moments with the Wrocc superman Steve Fryatt – ace Risc os software author, Risc os frontend maintainer for Netsurf, Wrocc newsletter editor and amateur dramatics backstage supremo are just some of the strings to his bow. He tells me he has very little time at the moment to spend on his own Risc os software. (Hmm. The next day, Sunday April 17, Steve announces updates to his PrintPDF and Cashbook applications. He must have got momentarily caught up in traffic or something.)

I buy the Netsurf 2.7 CD from the lads on the Netsurf stand as a small token in

The Netsurf team released version 2.7 of the browser. Frontend RISC OS code is by Steve Fryatt.

Other software releases at the show:

- *Matthew and Hilary Phillips (Sine Nomine Software) had an upgrade to Impact, the database system, and a new puzzle package called Wrangler.*
- *Organizer, maintained by Martin Avison, can now add a thumbnail picture alongside a contact's address and telephone details.*

return for all of their hard work and receive a mint sweet in exchange. I always download and use the "bleeding-edge" development version myself, but even when I have had a problem, either someone else has reported it or the problem has been fixed.

One of the ROOL guys catches up with me and informs me that my recently purchased C-and-C++ CD has not had an image burnt to it. He takes it away and soon a fixed CD is placed back in my hands. All good stuff, eh? I buy the ROOL mug. A MUG member can't have too many RISC OS-type mugs in his collection, says I.

I trade a few pleasant words with Vince Hudd, who is showing off the Webchange ability to make thumbnails of a picture gallery. He shows me his Armini box and mentions that he only just had time to set his stall up before the show opened.

After a close inspection of the little Armini from R-Comp, Vince Hudd (aka Soft Rock Software) bought one. R-Comp also had a new version of Safestore, the backup software, ready for the show.

Looking at his minimalist stand I invite him to look at Martin (Top-poster) Hansen's Mathmagical stand, which probably has his wife's kitchen sink buried somewhere in it.

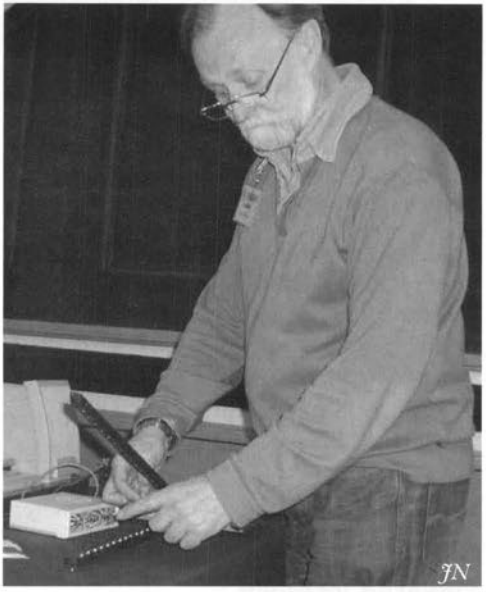
Thinking of Mathmagical reminds me that unlike Vince he has something to sell me. Martin is, as expected, full of goodwill and I part with some more of my now-depleted cash fund in return for software.

Elevated letdown

Time is passing by and Doug is at his last show presentation. I am idly talking to

Retro Software's displays featured a non-retro innovation: the Video Upscaler from CJE Micros, which enables the venerable Beeb to drive a modern monitor at higher resolution than it ever imagined.

some of my fellow Wrocc members when they get news that the hotel's lift has broken down. This causes consternation, not least for me: visions of being roped in to carry huge amounts of goods down lots of stairs. Fortunately a news update comes in that the lift is fixed, sort of. The lift can be used, but for goods only, no people.



Mike Cook, who wrote "bodybuilding" articles for many years ingeniously exploiting the BBC Micro's interfaces, showed off some more recent elecronic gadgets at Wakefield. You stroke beams of light to produce sounds on this light-harp.

Turned up this photo of Mike Cook at a 1985 show.

Doug appears and after he has a chat to Andrew Rawnsley we set off for home. We compare notes and find that we have spent roughly the same amount of cash. We discuss the Armini on the way home. Doug says he may have one for his birthday, despite having a Beagleboard. I tell him that due to my wife Christine's mishap with my Iyonix, a tale too full of horror to repeat here, I also may get an Armini – this despite having a Beagleboard that Doug is helping me to get up and running.

Food footnote

*This breakfast was so large that when we later went for lunch at the Navigation Inn, a quarter-mile up the road, which I had agreed to pay for, Doug was still too full of breakfast to eat. Adding to his woes *he* bought the beer, at a price per pint roughly equal to an arm and a leg.

Ron Briscoe *ron.briscoe@blueyonder.co.uk*

This isn't Doug's arm and leg; it's Ron's eye and nose. He lives in Birmingham and belongs to the Midlands User Group (Mug); he is also a paid-up member-afar of the Wakefield club.

And next year?

Rick Sterry, the Wakefield club's assistant organizer for the show, reports: "From our point of view it all went off fairly well, with visitor numbers slightly up on last year. It's a pity about the the lift failing and the afternoon duty manager who evidently thought that *Fawlty Towers* was a training video!

"As to whether we will be masochists yet again in 2012, it really is far too early to say – we quite like having a few months when we can stop thinking about the show!"

Deutsche Risc os-Treffungen

Jim Nagel

Viola and I were on holiday in Germany in August, visiting the local musikmeister at Rinteln, a wonderful medieval town within earshot of the Pied Piper (known there as simply the Ratcatcher of Hameln). In her student days Viola had been soprano soloist in many a Rinteln production. Our impresario, now retired, was expecting a visit from a tech-wizard friend who is making CDs from his old recordings, using "a rare computer system that he prefers".

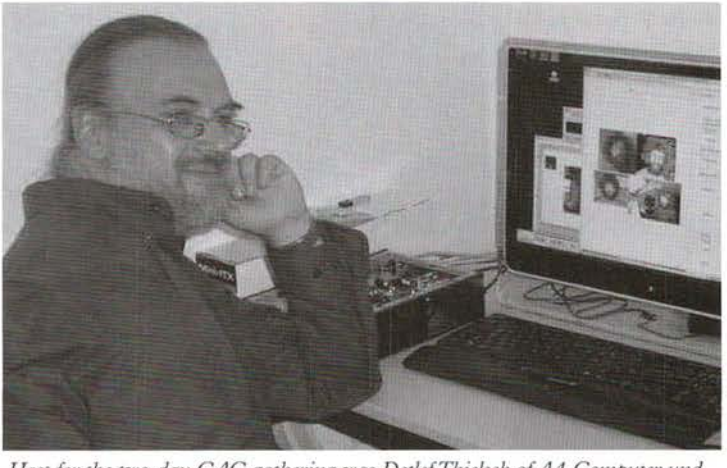
Surprise, surprise,the rarity is Risc os, and Archive immediately had a new subscriber in Andrew Middleton (English dad, German mother, grew up in Rinteln; no relation to Paul Middleton of Riscos Ltd). Moreover, he was driving to the Risc os gathering in eastern Germany on August 20–21 and would I like to come along?

Though I had often visited Germany, I had never been to the former East Zone – and this turned out to be my second time in two weeks. (The first was to meet a long-lost branch of the Nagel clan. It was an insight into two centuries of family roots I'd never known before – that's another story.)

The annual gathering was organized by GAG, the German Archimedes Group (*gag.de*). Members came from far-flung parts of Germany, some of them six hours away on the autobahn, to show off their current projects to one another. At last I was able to match faces to some names I'd seen for years in the Risc os newsgroups.

One was Herbert zur Nedden, the editor of *GAG News*, begun in 1992 and published bimonthly ever since. He drove from near Hamburg. Several of the photos here are by him, but somehow his face was never caught in front of the lens.

Michael Gerbracht, now living and working in Berlin, was there with the latest update of his Luafox statistical software.



Host for the two-day GAG gathering was Detlef Thielsch of A4-Computer und Informationssysteme, in Wölfen. Here he shows that he and Thomas Milius have cured a longstanding cut-and-paste bug in Photodesk, using his BiK.

Und im Westen

A fortnight later, after I was back in England, the Arche 2.0 meeting took place in Essen, at the fascinatingly named Unperfekthaus, which has the famous policy of charging on the way *out*. The Arche Acorn User Club, with members mostly in the Ruhr area in western Germany, meets several times a year. Holger Palmroth (*holger.palmroth@cneweb.de*) promises a photo and report next time.

Rene Fischer, from Berlin, with the Beagleboard he fitted into the case of a working DVD player. He's the man who last year built the BiK – Beagleboard in einer Kiste (box) – sold through A4-Computer.

And this (left) is the Beagleboard he fitted to the back of a screen. The white USB stick is a Vodafone wireless internet connection.

Thomas Milius had his Beagleboard on the local network via a USB dongle (below).

His face!

Steffen Huber tweaking his CDVDburn software to run with a stack of different drives and discs. He and Stefan Bellon (get the two spellings straight!) drove the 500km from Stuttgart together. Stefan (right) is the man to thank for RemoteprinterFS if your network includes a printer, for lots of utilities over the years, 32-bit Fontdir Pro and for the games Minesweep and Reversi (sbellon.de).

The venue was A4-Computer (a4com.de), a longstanding RISC OS dealer on the whole of the second floor above a pharmacy in Wölfen, a small town that is now part of the city of Bitterfeld. This is one vertex of what was called the Chemical Triangle in the days of the Communist regime. Terrible pollution has been cleaned up in the 20 years since German reunification. Where once stood belching factories and shoddy blocks of flats to house workers who have moved west, today there are open spaces and clean air – actually quite pleasant.

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Wikipedia and Riscos

Trevor Johnson

Presenting an accurate encyclopedic entry for RISC OS and associated subjects is important. It demonstrates that the platform is still alive and that it has a future. The WIkiproject means that it's now easier for people to work together to improve articles. The more editors we have, the more quickly the improvement goals can be reached.

Wikipedia's relevance

The English Wikipedia (*en.wikipedia.org*) has 3,672,003 articles – at the moment of writing this – 3,673,773 two hours later! – and approaching 15 million registered users. Get these statistics and more by typing `special:statistics` into the Wikipedia search box.

According to the three-month Alexa worldwide rankings of website traffic, Wikipedia is currently number 7. These rankings rely on instances of Alexa Toolbar installations, but are still generally accurate for the more popular sites.

The top ten current worldwide sites according to Alexa (*alexa.com/topsites*):

1. Google
2. Facebook
3. Youtube
4. Yahoo
5. Blogger
6. Baidu
7. Wikipedia
8. Windows Live
9. Twitter
10. QQ.com

The relative low ranking of Twitter could be inaccurate. Both Twitter and Wikipedia applications exist for smartphones and mobile internet devices (MIDs) but are not compatible with the Alexa Toolbar, which gathers statistics for the rankings.

Baidu is a Chinese-language search service, China's answer to Google. And QQ.com is that country's largest and most used internet portal, owned by Tencent Inc, founded in 1998. The portal offers email, forums, instant messaging (990 million users) and online shopping by mobile phone.

This ranking confirms what we already knew: Wikipedia is popular – whether the user seeks it actively or is referred there by search engines.

Relationship to Riscos.info

I exchanged emails with both Peter Naulls and John Tytgat, the founders of *riscos.info*, about whether the wiki project conflicts with their site. "Wikipedia is an encyclopedia; Riscos.info is not," Peter said. John sees no ambiguity or misunderstanding and considers that the sites complement each other. Both wished us good luck. Peter referred me to the notes that both sites include about themselves:

• "Wikipedia is an online encyclopedia and, as a means to that end, an online community of individuals interested in

building a high-quality encyclopedia in a spirit of mutual respect." (Source: `wp:not` at *wikipedia.org*)

• "The Riscos.info wiki is a community- and developer-driven Risc os website, intended to encourage user involvement [and to] provide a forum for Risc os articles, news and other media." (Source: `risc_os:about` at *riscos.info*)

Each site is clearly focused and therefore there should be no misunderstandings for visitors.

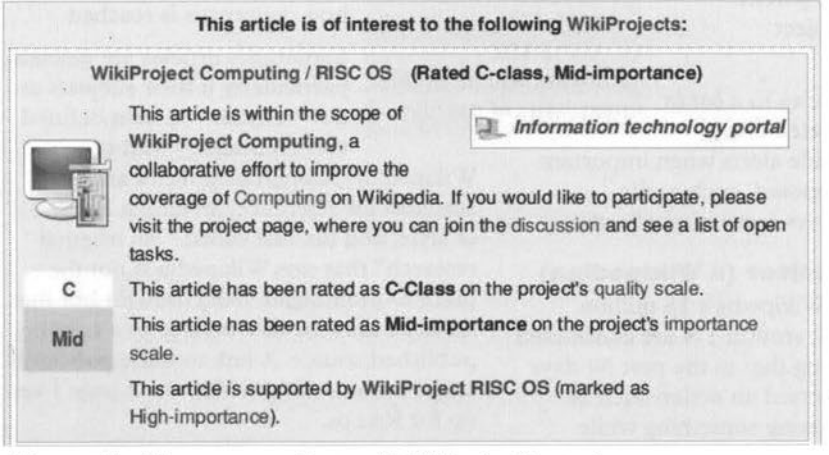
The project is conceived

Users of Acorn computers and their Risc os descendants could, in the past, be proud of some relevant Wikipedia articles. As an example, editors had worked hard to get the "Acorn Computers" article promoted in 2005 to the quality class of GA (good article). But subsequently the cumulative effect of an overall improvement in article quality throughout Wikipedia and a number of biased (though presumably well intentioned) edits to the Acorn article resulted in its being demoted in 2008. It is currently rated as C-class. (Article quality and importance classes, where available, are shown on their respective talk – or "discussion" – pages within Wikipedia. Here's an example: *en.wikipedia.org/wiki/Talk:Acorn_Computers*

Inaccurate or obviously biased Wikipedia pages can leave readers confused. I felt a little confused myself a couple of years ago and began making the odd edit here and there. As I gained the confidence in making edits to Wikipedia (mainly typos to begin with), I became aware of the existence of Wikiprojects, such as UK roads, Video games, Amiga and Rational skepticism.

It occurred to me that improving the quality of articles could perhaps be made easier if Risc os had its own Wikiproject. So I announced the proposed project, and a few interested people contributed some online comments. A few weeks after this, Peter Howkins and I came to the conclusion that we might as well get on and set it up.

Some of the Wikipedia advice, policies and procedures are a bit ambiguous, and as a result we jumped the gun a little – for example, we didn't have a list of core contributors to support the proposal. But, arguably, recruiting members would be difficult without a project actually in place.


This article is of interest to the following WikiProjects:
WikiProject Computing / RISC OS (Rated C-class, Mid-importance)
This article is within the scope of WikiProject Computing, a collaborative effort to improve the coverage of Computing on Wikipedia. If you would like to participate, please visit the project page, where you can join the discussion and see a list of open tasks.
Information technology portal
C
This article has been rated as C-Class on the project's quality scale.
Mid
This article has been rated as Mid-importance on the project's importance scale.
This article is supported by WikiProject RISC OS (marked as High-importance).

A banner like this appears on talk pages for Wikiproject Computing.

Peter and others had already made many

improvements to Wikipedia articles before the project existed. Besides his continuing improvements, Peter has also taken a central role in facilitating the assessment scheme.

It's live

Now that the project is live, it has enabled the following to be done:

- Place prominent identification tags on articles relevant to Risc os, its hardware and software. These tags are more useful than Categories alone. The example on the previous page is included within a banner on talk pages for Wikiproject Computing.
- Classify these articles in terms of importance and quality.
- Discuss general matters and priorities for creating and improving articles – in one place, separate from the specifics of individual article content.
- Establish some dialogue with members of the parent project, Wikiproject Computing.
- Subscribe articles to a *bot* (a robot or automated user) which can provide alerts when important changes are proposed, such as file deletions or moves (renaming of articles).

Become an editor (a Wikipedian)

Of the English Wikipedia's 15 million registered users, around 1% are considered "active", meaning that in the past 30 days they have performed an action such as editing or discussing something while logged in. That doesn't mean that less-active users are necessarily less valuable. Most sensible contributions (in line with Wikipedia's principles) will be welcomed, however small.

Wikipedia's principles are summarized in its "Five Pillars":

- It's an encyclopedia, not a number of other things
- It has a neutral point of view
- Content is free (with some justifiable fair-use exceptions)
- Wikipedians should be respectful to one another and find consensus
- There are no firm rules!

It's fair to say that the vast majority of Wikipedians are helpful, knowledgeable and polite. But becoming a Wikipedian means accepting that article content is constantly revised *["mercilessly edited" is the phrase in the Third Pillar. Hmm, sounds like Archive, doesn't it, Trevor? —Ed.]* That's how Wikipedia evolves and how consensus is reached.

Sometimes articles are deleted, particularly if their subjects are not "notable" (a term defined – and discussed – within Wikipedia). Numerous policies are available for reference, including a manual of style, and the one called "No original research" that says Wikipedia is not the place to promulgate fresh thought but that material must be attributable to a reliable, published source. A link to these policies is at the bottom of the Wikiproject page I set up for Risc os.

Occasionally an edit war breaks out – the

Brain-teaser

As a bit of fun (and preferably without using your computer), see if you can work out what the following Wikipedia shortcuts relate to. Most items are mentioned above.

WP:5P
WP:NPOV
WP:GA
WP:BB
WP:WAR
WP:MOS
WP:NOR
WP:WP
WP:CAT
WP:FAIR

Answers will be in the next issue of Archive.

revision history for the article "Pope", for instance, shows a rapid dingdong between "revision" and "reverted" in one three-day period. Disputes can often be resolved via discussions on the relevant talk page. Recourse to third-party opinions, requests for comment (RfC) and other dispute-resolution mechanisms is also available if required.

Editors are encouraged to be bold when updating articles, so if you've not yet done so, why not have a go! Remember that anyone can become a Wikipedian!

How can I help?

Have a look around and join in. Perhaps you have a stack of old Acorn-related newspaper cuttings, or maybe you're an amateur photographer with access to some old hardware. It would also be useful to hear from anyone with experience in publishing and proofreading.

And if you're simply a plain old Risc os user, if anything you've read here strikes a chord with you then come and join the party! The project can be found at *wikipedia.org* by typing `WP:RISCOS` into the search box.

Trevor Johnson *trevj@cwazy.co.uk*

Trevor went several weeks without his camera after Wakefield. It was in his rucksack, which was mistakenly taken from the luggage rack by someone who then handed in at Birmingham New Street. His parents collected it because the lost-property office wouldn't send it down to Bristol.

The new discs will be posted with the next issue of the magazine.

Order now or at the Archive stand at the London Risc os show on October 29.

Archive DVD or CDs

The entire contents, nicely indexed, of the past 22 volumes of Archive magazine – in HTML format, plain text and as the original Impression documents – on a DVD. For users who still have only a CD reader, almost all the same content is still also available as a pair of CDs at the same price.

The DVD also contains all issues of volume 22 in PDF format (not enough room on the CD, unfortunately).

DVD22 or CD22 costs £21 **(or £11 as upgrade from last year. Unless you specifically request special despatch, upgrades will be posted with your next magazine.)**

Please send cheque to "Abbey Press" at address on back cover, or pay via direct bank transfer with an email to confirm – sortcode **08-92-50** *(Co-op, Skelmersdale), account* **7072 6592** *(Abbey Press). Another route (less cost-effective) is via Google Checkout at www.archivemag.co.uk (Prices page).*

Connectivity

Gerald Fitton

Your hip bone connected to your back bone,
Your back bone connected to your shoulder bone,
Your shoulder bone connected to your neck bone,
Your neck bone connected to your head bone,
I hear the word of the Lord!

From the gospel song "Dem Bones"
based on Ezekiel 37:1–14
James Weldon Johnson (1871–1938)

In this article I shall describe, with a couple of examples, how we can find the exact numerical value for the derivative of a function at a point (for example, the speed of a particle) using a Calculus of Finite Difference formula — which can be, and still is, used when we know nothing but the value of the function (for example its position in space) at a few points.

Speed at a point is a notion that has troubled mathematicians and philosophers for millennia. Zeno's Arrow Paradox, which I described in *Archive 22:12*, highlights the problem. The concept that makes "speed" meaningful is the *connectivity* of (in other words, the *continuity* between) irrational numbers such as those numbers adjacent to $x = 2$. Zeno could not conceive of irrational numbers nor of the associated unidentifiable adjacent points.

The falling cannonball

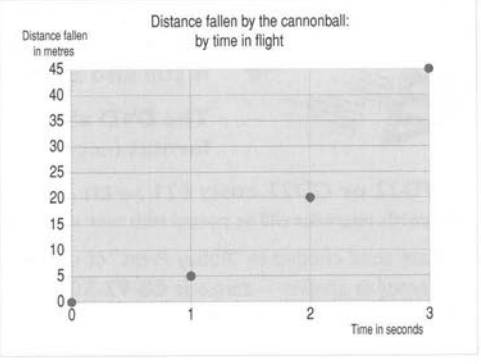
I start with a graph taken from *Archive 22:12* showing the distance a falling cannonball has travelled after being dropped from the top of the Tower of Pisa.

Our objective is to determine "exactly" the speed of the cannonball two seconds after it has been released; at this time it has fallen through 20 metres. By "exactly" I do not mean the approximate value given by $\Delta y/\Delta x$ when Δx is small; I really do mean "exactly".

Of course one way of doing this which you will have learned about at school (but now forgotten), is to find an analytical function that fits all the known four points and then differentiate that function. You can find this function using the techniques of matrix algebra which I described in *Archive 22:8* and then differentiate it using A-Level calculus.

You may not have a lot of trouble using this matrix technique to find the analytical function, $s = 5t^2$, relating s, the distance the cannonball has fallen, to its time of flight, t. However, if you had a hundred points so that you needed to find a polynomial of the 100th power, then inverting the huge 100×100 matrix might cause your computer to shudder!

In this article I shall show you how to find the speed using a much simpler



calculation, one that will give your computer no trouble whatever. What's more, there will be no dividing by near-zero quantities. The Finite Difference formula I'll use contains only fully understandable Rational Numbers from the set $\mathbb{Q}$, numbers easily handled by a computer.

Calculating the speed using 'Del'

Have a look at the screenshot below. Columns A and B contain the four points on the trajectory of the cannonball, (0.00, 0.00), (1.00, 5.00), (2.00, 20.00) and finally (3.00, 45.00).

Ah! You spotted my deliberate mistake! I added a fifth point at (4.00, 80.00); this last point represents the height through which the cannonball would have fallen if it hadn't hit the ground at the bottom of the Tower of Pisa. It would have fallen through 80 metres. Please allow me a little mathematical licence here. As you will see later, we don't really need this point to find the velocity two seconds after the cannonball was released, but, for now, let's include it rather than introduce another complication before you've grasped the simplicity of the quite (mathematically) beautiful calculation I've used to find the speed of the cannonball.

We met the formulae in columns C, D and E in Archive 22:12; for example the formula in D5 is `C6 - C5`. The two new columns are columns H and I. In column H, headed "D", I have used differential calculus to calculate the speed of the cannonball as $v = 10t$ at the points corresponding to the times in column A. In column I, headed "ln(1+Del)", I have have used the Calculus of Finite Differences to calculate this speed. The two answers are identical.

My column heading for column I is "ln(1+Del)" where "ln()" means "the natural logarithm of". The formula I used to calculate the value of this function for I4 is shown in the screenshot as `C4-D4/2+E4/3`. If I were to continue this infinite series then it would be

```
ln(1+Del) = C4-D4/2+E4/3-F4/4+ ...
```

For our example all terms after `E4/3` are zero.

Now you have to agree with me that this is a very simple formula; I assure you that it gives a completely accurate, exact value for the derivative of the function for which we have found the set of Finite Differences (from Δ^1 onwards) for that point. Not only is it a very simple formula but it is something that a digital computer can do "with its eyes closed"! Here we have a formula for calculating the exact speed of the cannonball when we know where it is at several different, but totally identifiable, moments in time. There is none of this rubbish about "in the limit as Δx tends to zero" about this formula; it gives the exact answer to the question "What is the speed of the

PipeDream: hostfs::Gold.$.Arc.2011.GC1102.Files.Pipe.quad-01

C4-D4/2+E4/3

	A	B	C	D	E	F	G	H	I
1									
2	x	Quadratic	Del	Del^2	Del^3	Del^4		D	ln(1+Del)
3									
4	0.00	0.00	5.00	10.00	0.00			0.00	0.00
5	1.00	5.00	15.00	10.00	0.00			10.00	10.00
6	2.00	20.00	25.00	10.00				20.00	20.00
7	3.00	45.00	35.00					30.00	
8	4.00	80.00							

cannonball?" without resorting to those very difficult-to-understand infinitesimal quantities that may be somewhere in space and time but, by their very nature as Irrational numbers, are unidentifiable.

Calculating the speed using 'Nab'

In the next screenshot you will see I have written "Nab", which is short for Nabla and given the symbol ∇; it is an upside-down Delta. Δ is the "forward difference operator", and ∇ is the "backward difference operator". The identity defining ∇ is $\nabla = I - T^{-1}$ where $T^{-1}(T) = I$.

Have a look at the screenshot and you'll see I added rows 11 to 17 to the previous spreadsheet. Although I don't show it in the screenshot, the value in, for example, C14 is `B14-B13`; this is replicated to fill C17F17; the formula in D16 is `C16-C15`.

You will notice that the heading in cell I11 is "ln(1−Nab)" and the formula in I15 contains only "+" signs rather than the alternate plus and minus signs of the "ln(1+Del)" column.

I did ask you to grant me mathematician's licence to continue 40 metres into the ground at the bottom of the Tower of Pisa. Using the Nabla (backward difference) formulation of the problem (to calculate the exact speed at a point) you will see that we didn't need to do all that excavation. Indeed, using the "ln(1−Nab)" formulation, not only do we have the speed of the cannonball one second before it hits the ground but also we have, as a bonus, an exact speed of 30 metres per second for it when it hits the ground.

Derivative of the cubic function

In *Archive 23:1* I told you that we would calculate the exact value of the derivative of the cubic function at $x = -1.00$ using the Calculus of Finite Differences. As you can see from the spreadsheet on the next page, the two formulae, the expansions of ln(1+Del) and ln(1−Nab), can be used with this cubic. The factor of 4, for example in I4, is introduced into this calculation because the interval for our finite differences is 0.25 rather than 1.00.

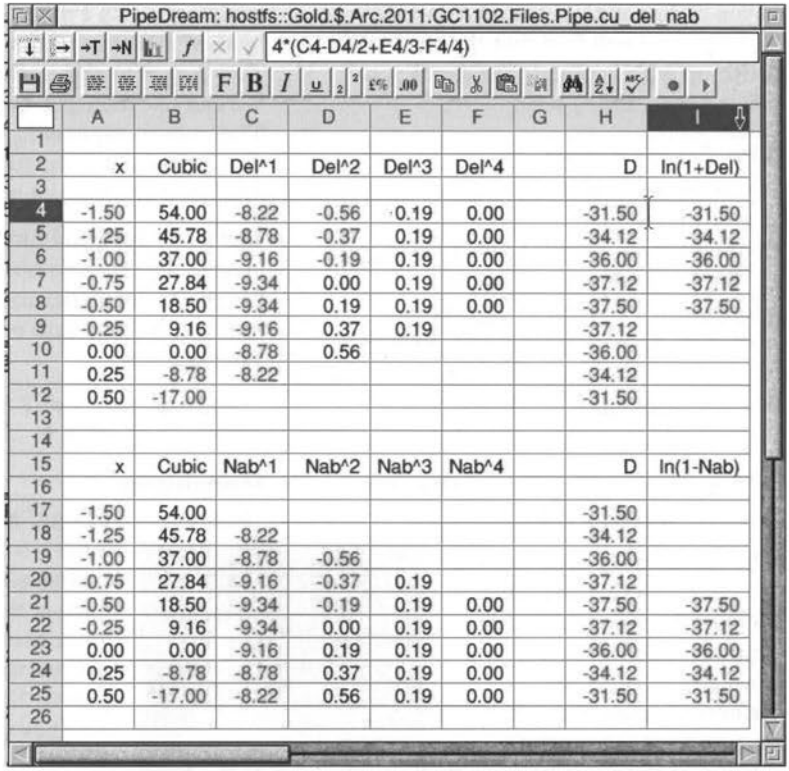
PipeDream: hostfs::Gold.$.Arc.2011.GC1102.Files.Pipe.qu_del_nab

C15+D15/2+E15/3+F15/4

	A	B	C	D	E	F	G	H	I
1									
2	x	Quadratic	Del	Del^2	Del^3	Del^4		D	ln(1+Del)
3									
4	0.00	0.00	5.00	10.00	0.00	0.00		0.00	0.00
5	1.00	5.00	15.00	10.00	0.00			10.00	10.00
6	2.00	20.00	25.00	10.00				20.00	20.00
7	3.00	45.00	35.00					30.00	
8	4.00	80.00						40.00	
9									
10									
11	x	Quadratic	Nab^1	Nab^2	Nab^3	Nab^4		D	ln(1-Nab)
12									
13	0.00	0.00						0.00	
14	1.00	5.00	5.00					10.00	
15	2.00	20.00	15.00	10.00				20.00	20.00
16	3.00	45.00	25.00	10.00	0.00			30.00	30.00
17	4.00	80.00	35.00	10.00	0.00	0.00		40.00	40.00
18									

I assure you that this method of finding "the speed at a point" works perfectly for all polynomials and – please let me emphasize yet again – that there is no need to introduce those adjacent but difficult-to-locate Irrational numbers, nor is there any need

to introduce phrases such as "in the limit as Δx approaches zero", the like of which we are taught to recite at school even when we have no idea what an infinitesimal Δy or Δx looks like!



	A	B	C	D	E	F	G	H	I
1									
2	x	Cubic	Del^1	Del^2	Del^3	Del^4		D	ln(1+Del)
3									
4	-1.50	54.00	-8.22	-0.56	0.19	0.00		-31.50	-31.50
5	-1.25	45.78	-8.78	-0.37	0.19	0.00		-34.12	-34.12
6	-1.00	37.00	-9.16	-0.19	0.19	0.00		-36.00	-36.00
7	-0.75	27.84	-9.34	0.00	0.19	0.00		-37.12	-37.12
8	-0.50	18.50	-9.34	0.19	0.19	0.00		-37.50	-37.50
9	-0.25	9.16	-9.16	0.37	0.19			-37.12	
10	0.00	0.00	-8.78	0.56				-36.00	
11	0.25	-8.78	-8.22					-34.12	
12	0.50	-17.00						-31.50	
13									
14									
15	x	Cubic	Nab^1	Nab^2	Nab^3	Nab^4		D	ln(1-Nab)
16									
17	-1.50	54.00						-31.50	
18	-1.25	45.78	-8.22					-34.12	
19	-1.00	37.00	-8.78	-0.56				-36.00	
20	-0.75	27.84	-9.16	-0.37	0.19			-37.12	
21	-0.50	18.50	-9.34	-0.19	0.19	0.00		-37.50	-37.50
22	-0.25	9.16	-9.34	0.00	0.19	0.00		-37.12	-37.12
23	0.00	0.00	-9.16	0.19	0.19	0.00		-36.00	-36.00
24	0.25	-8.78	-8.78	0.37	0.19	0.00		-34.12	-34.12
25	0.50	-17.00	-8.22	0.56	0.19	0.00		-31.50	-31.50
26									

Another operational symbol

I have introduced you to Δ, T, I and, in this article, ∇, the backward difference operator. I have shown you the relationship between them and mentioned that the inverse of T is T^{-1}.

Now here's an old friend: the operator D is the "differential operator".

If we have $y = f(x)$ then $Dy = dy/dx = f^1(x)$, where $f^1(x)$ is the notation I shall use for the first derivative of the function $y = f(x)$. Similarly $D^2y = d^2y/dx^2 = f^2(x)$, the second derivative of the function $y = f(x)$.

Infinite series $y = e^x$

Different universities take different approaches to the definitions of Transcendental Functions such as e^x, $\ln(x)$, $\sin(x)$, $\cos(x)$, etc. Some use differential calculus and some use infinite series; there are other definitions that could be and are used as starting points. It doesn't really matter which definition you use, for it is possible to show mathematical consistency between all the various definitions.

I shall concentrate on the function $y = e^x$ as my first example.

This function (of a Real Variable) can be defined thus: "$y = e^x$ is the function for which $D(y) = y$". In other words, the derivative of this function is itself. From there it takes little imagination to discover that not only the first derivative of $y = e^x$ is e^x but that every derivative is e^x too. In Operational Notation, $D^n(e^x) = e^x$ for all n.

Another equivalent definition of $y = e^x$ is the infinite-series representation:

$$y = e^x = 1/0! + x/1! + x^2/2! + x^3/3! + x^4/4! + \ldots$$

If you differentiate this infinite series term by term, you will find that the series you finish up with is exactly the series you started with. $D(e^x) = e^x$.

The Taylor Series

It was 40 years after the death of Brook Taylor that the famous French mathematician Joseph Louis Lagrange (1736–1813) described Taylor's eponymous Theorem as "*le principal fondement de calcul différentiel*". Taylor's Theorem or the Taylor Series representation of a function $y=f(x)$ is:

$$y = f(x_0 + h)$$
$$= f(x_0) + hf^1(x_0)/1! + h^2f^2(x_0)/2! + h^3f^3(x_0)/3! + \ldots$$

The subscript 0, used in $f(x_0)$ etc, indicates that the function $f(x)$ has the value $f(x_0)$ at the point at which $x = x_0$. Similarly $f^4(x_0)$ is the numerical value of the fourth derivative of the function $y = f(x)$ at the point where $x = x_0$. The h that appears in the formula is the distance away from $x = x_0$ at which we wish to calculate the value of $y = f(x_0 + h)$.

I shall make no attempt to prove to you this groundbreaking and hugely important theorem. Among many other things (see the boxout) it allows us to link together the two Calculi of Finite and Infinitesimal Differences. Here's how they're linked. If we have an ordered series (such as the values of a function at integer values of x) which we are analysing using Finite Differences with an "index" (the size of the step) h, then $T_h = f(x_0 + h)$ and $\Delta_h = f(x_0 + h) - f(x_0)$. We can use the right-hand side of Taylor's Theorem to express T_h or Δ_h in terms of all the derivatives of the function $y = f(x)$ evaluated at the point where $x = x_0$.

The transcendental function $y = e^x$ has an inverse. The inverse is $x = \ln(y)$. We can use the Taylor Series to expand the function $\ln(1+z)$ into an infinite series. That series is:

$$\ln(1+z) = z/1 - z^2/2 + z^3/3 - z^4/4 + z^5/5 - z^6/6 + \ldots$$

Brook Taylor was born 1685 at Edmonton in Middlesex (now north London) and initially trained as a musician. He first stated his famous theorem in 1712, but its full significance was not recognized until 1772. Taylor was also a gifted artist and set out the basic principles of perspective: the book he is pointing at. He died in 1731.

The miniature watercolour of Taylor, probably by Louis Goupy in 1720, is in the National Portrait Gallery.

Morphisms

"Arguing by analogy" is considered an orator's trick because the analogy all too often breaks down at the point when the orator reaches his false conclusion. I repeat from Archive 22:12 that algebraic identities such as $(a^2 - b^2) = (a + b)(a - b)$ can be extended for use in Operational Calculus. These Morphisms are a totally rigorous method of "arguing by analogy". Mathematicians first prove that the analogy will continue to be applicable right through to the end of the theorem, so that the conclusion, arrived at using this special sort of analogy, is totally valid.

The Taylor Series, which is usually written as

$$y_h = f(x_0 + h)$$
$$= f(x_0) + hf^1(x_0)/1! + h^2f^2(x_0)/2! + h^3f^3(x_0)/3! + \ldots$$

can also be written in Operational Format (using the Differential Operator 'D') as:

$$\begin{aligned} f(x_0 + h) &= T_h(y) \\ &= h^0D^0(y_0)/0! + h^1D^1(y_0)/1! \\ &\quad + h^2D^2(y_0)/2! + h^3D^3(y_0)/3! \\ &\quad + \ldots \end{aligned}$$

Note that $h^0D^0(y_0)/0! = I(y_0) = f(x_0)$.

Now, here's an interesting Morphism that uses the infinite series for the exponential function (of a variable such as x) as a Morphism for the Taylor Series. By comparing the series on the right, for which a typical term is $h^nD^n(y)/n!$, with the infinite series for the exponential function $y = e^x$ we can write the Taylor Series for the value of the function at $x = (x_0 + h)$, namely $y = f(x_0 + h)$, as the operational identity

$$T_h(y_0) = e^{hD}(y_0)$$

or, without the y_0, the operational identity is

$$T_h = e^{hD}$$

With elegant simplicity, this identity contains the profound essence of Taylor's Theorem. A mathematician (such as I am) would call this identity "beautiful". As a by-the-way, ask yourself why T was chosen (not randomly) as the symbol for the shift operator!

'Doing it inverted!'

I'm never sure whether "Mathematicians do it backwards" or "Mathematicians do it inverted" is the better explanation for this productive process. We've done "backwards" in enough previous articles, so this time let's go for "inverted".

I shall remind you that the inverse of $y = e^x$ is $x = \ln(y)$. *[Sometimes pronounced "lon", ln is the "natural logarithm", whose base is the number* e, *as opposed to* log, *the "common logarithm", whose base is 10. —Ed.]*

The "clever bit" is to invert the Operational Identity, $T_h = e^{hD}$ which represents Taylor's Theorem, to give us another beautiful identity, the Inverse Taylor's Theorem, $hD = \ln(T_h)$.

Substituting for T_h using $T_h = I_h + \Delta_h$ we arrive at the identity connecting the first derivative, $D(y)$ with the set of Forward Finite Differences, $\Delta^0{}_h$, $\Delta^1{}_h$, $\Delta^2{}_h$, $\Delta^3{}_h$, $\Delta^4{}_h$, $\Delta^5{}_h$ etc. Both the derivative, D, and all the finite differences, $\Delta^n{}_h$, are for the point where $x = x_0$.

This identity is

$$\begin{aligned} hD &= \ln(I_h + \Delta_h) \\ &= \Delta^1{}_h/1 - \Delta^2{}_h/2 + \Delta^3{}_h/3 - \Delta^4{}_h/4 + \ldots \end{aligned}$$

Similarly

$$\begin{aligned} hD &= \ln(I_h - \nabla_h) \\ &= \nabla^1{}_h/1 + \nabla^2{}_h/2 + \nabla^3{}_h/3 + \nabla^4{}_h/4 + \ldots \end{aligned}$$

Summary

These two Inverse Taylor Identities for hD, the two infinite series on the right, are those I used to calculate the exact speed of the cannonball two seconds after its release. I found the exact speed without using any (what does "adjacent" mean?) Irrational Numbers and without resorting to the difficult-to-understand concept, learned by rote at school and then meaninglessly intoned as, "the limit of $\Delta y/\Delta x$ as Δx tends towards zero".

Digital computers do sums using Operations (such as T, I, Δ and ∇) on sets of Rational Numbers such as the position of a cannonball – or planet or wave front – at any (Rational) time. Digital computers cannot play around with concepts (such as differentiation) because digital computers do not have a means of identifying Irrational Numbers.

Morphisms and Operational Identities are

used by mathematicians who need to use computers to calculate, for example, the exact path of the next eclipse. Whatever Calculus (there are many more than I've mentioned up to now) is used initially to formulate the "problem", when it comes to doing the calculations, whether using a computer or, as was the case before computers, manually, they have to use Rational Numbers from the set ℚ, and Operations (such as T, I, Δ and ∇) that can be applied to Rational Numbers.

The interconnectivity of everything

To see the world in a grain of sand,
And heaven in a wild flower,
Hold infinity in the palm of your hand,
And eternity in an hour.
"Auguries of Innocence"
William Blake (1757–1827)

Blake's genius was largely unrecognized in his own lifetime; his contemporaries considered him mad for his idiosyncratic and mystical views.

(Painting by Thomas Phillips, 1807)

Taylor's Theorem is a mathematical identity that can be and has been applied in classical physics to connect together everything that exists, has existed and will exist to absolutely everything else in the universe in both time and space.

The Taylor Series is usually written as:

$$y_h = f(x_0 + h)$$
$$= f(x_0) + hf^1(x_0)/1! + h^2f^2(x_0)/2! + h^3f^3(x_0)/3! + \ldots$$

Also it can be written using the Differential Operator "D" as:

$$f(x_0 + h) = \mathrm{T}_h(y)$$
$$= h^0\mathrm{D}^0(y_0)/0! + h^1\mathrm{D}^1(y_0)/1! + h^2\mathrm{D}^2(y_0)/2! + h^3\mathrm{D}^3(y_0)/3! + \ldots$$

I'd like you to consider the implications of this expansion.

It means that if we know the exact numerical value of all the derivatives of a function at just one point, the point $x = x_0$ (e.g. the speed, acceleration, etc), then we can apply Taylor's Theorem to calculate – not approximately, but *exactly* – the value of that function at any other point in space throughout the universe and at any time throughout all eternity. Detailed information about a function in the form of numerical values (not as a function) for every derivative of that function is all that we need in order to calculate a numerical value for that function anywhere in space and at any time throughout eternity!

Truly, if we study a mathematical "grain of sand" in enough detail – if we determine the numerical values of all its derivatives at a point – then we can know everything about the universe.

The philosophical implication of Taylor's Theorem is that everything is interconnected with everything else with bonds that are not only unbreakable but also inevitable.

This leads me to ask, "Are all these numerical values for the derivatives actually features of the 'point' rather than anything at all to do with the elusive 'adjacent points'?" Do we really need to consider what happens when Δx approaches zero? Anyway, how close to zero does Δx have to be for a point to avoid being coincident and indistinguishable

from another point? I have to tell you that I'm not the only mathematician who has asked these searching questions. Can you give a meaning to an elusive, Irrational adjacent point?

Quantum Uncertainty has invalidated the Determinism implied by the interconnected continuum of Taylor's $T_h = e^{hD}$. Eternity consists of individual moments each of finite duration which don't interact with each other in the manner predicted by classical physics.

Gerald Fitton *archive@abacusline.co.uk*

Gerald, like Dirk Gently, believes in the interconnectedness of everything. Even though Quantum Uncertainty destroys the micro link implied by Taylor's Theorem, Gerald still believes that, Statistically but not Deterministically, everything is connected to everything else in all time and space.

Datapower: accented letters

Julian Fry

The standard Latin-1 character set includes many characters with accents. These can be incorporated into text fields within Datapower. In this article we will examine how they are treated. Note that the following discussion will cover all characters that can appear in a Datapower text field although accented characters – and such characters as ç and ø – may be of most practical interest.

We will build a database to illustrate the findings. We will look specifically at how these characters are treated when sorting and when searching.

The database

The database will be a simple one-table database with a single layout called Untitled. The table, called Table1, will have just two fields:

Character – Text – to hold a single character

Code – Formula – to calculate the Ascii code of the character.

The formula for the Code field is:

```
asc('Character')
```

Each record of this table will hold one of the Latin-1 characters between Ascii 65 and 255 inclusive; there will be no duplicates. We will display these records on a layout

'Mailto' limitations

In my last article (*Archive 22:12*) I described how the `mailto` command could be used directly from Datapower to send an email. However, I failed to highlight one of its major limitations, namely the maximum length of the command. In fact the command will be truncated after approximately 243 characters including the command itself, all the "To" and "Subject" strings and the "&Body=" string. This leaves scant room for the actual email content!

If a Datapower field contains a data value that starts with "`mailto:`", clicking on the field will also create an email in the same way, and using the same syntax as described last time. Unfortunately this has a similar restriction on the length of the string. In fact, if the string is longer than 235 characters a message to that effect will be produced and no email will be generated – not even a truncated one.

Thus, for any "real" situation, using `Sendmail` appears to be the only practical solution. Nevertheless, the method described last time for the creation of distribution lists from Datapower could have a practical application.

that is set to display all records and with a header where we will put our buttons and an input field (see later). We can then do searches and sorts on these records to see what results we get.

Having created the database we need to add the records as defined above. We will write a small script that deletes any existing records and then adds new ones in random order so that we can examine the affect of sorting.

The script to add the records

The script to load the records is:

```
On clickleft
// Define the variables
Dim rs as recordset, i as integer, t as
text, j as integer
// Delete any existing records
currentdb.createquerydef("","delete from
'table1'").execute
rs=currentrecset
// Initialize the string t
t=""
// Build a string containing all the
characters whose Ascii codes are between
65 and 255 inclusive. This will include
all the accented characters.
for i=65 to 255
 t=t+chr$(i)
next
// Take a character from a random
position in the string t, use it as the
character for the next record and then
remove it from the string
// Repeat this for all the characters
for i=65 to 255
 j=random(len(t))
 rs.addnew
 rs.field("Character").Setvalue(mid$(t,
j,1))
 rs.update
 t=left$(t,j-1)+mid$(t,j+1)
next
layout("Untitled","Join for Untitled")
```

A script to sort

We will also write two other scripts and put them behind buttons. The first will just provide an easy means of sorting the records on the character field. The other will read a character from an input field and search for it in the character field.

Each of these scripts requires a new query. The first of these, which I shall call Sorted, is initially:

```
Select '*'
From 'Table1'
Order By 'Character'
```

The initial query will sort the whole table but it would be useful to sort either the whole table or any subset we have selected. To do this the script will use the current query and add the sort to it. This will require the query Sorted to be modified. The script to do this is:

```
On Clickleft
// Define variables
Dim QD as QueryDef, SQL as text
QD=CurrentQdef
// Get the definition of the current
query and add the sort to it
SQL=QD.GetSQL+ " order by 'character'"
// Update the query Sorted with the
modified SQL
CurrentDB.QueryDef("Sorted").SetSQL(SQL)
// Re-display the layout with the
modified query
layout("Untitled","Sorted")
```

I will put this behind a button called "Sort on Character".

A script to search

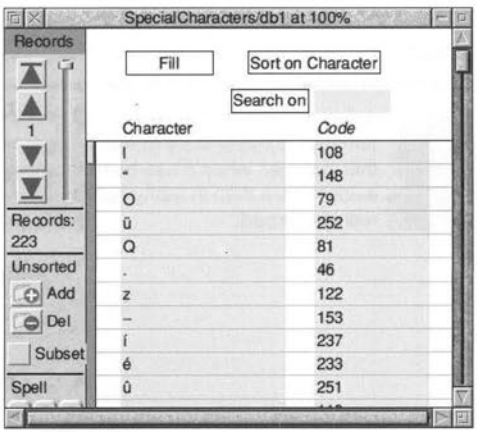
The second query, which I shall call Search on, is initially a dummy query. The script we will use to do the searching will modify this query so that it performs the required search. The query, which I shall

call Select, is:

```
Select '*' from 'Table1'
```

As we need to specify the character we wish to search on we need to add a new, unbound, field. Add this to the header of our layout and call it "Search on". We will use its title as a button behind which we will put the following script:

```
On clickleft
// Define variables
Dim c as Text, SQL as text
// Read the character to sort on
c=Input("Search on")
// For convenience we will allow the user to input a character in the form "chr$(nnn)". For single-character input we need to enclose it within doublequotes in the formula which generates the SQL string. For chr$(nnn) input it must not be enclosed in doublequotes.
// We will also allow the user to input two or three digits which we will assume to be the Ascii value of the character to be searched for.
if instr(c,"chr$")>0 then
 c="'Character'="+c
else
 if len(c)>1 then
 c="asc('Character')="+c
 else
 c="'Character'="""+c+"""
 endif
endif
// Modify the SQL of the query to perform the desired search
CurrentDB.QueryDef("Select").setsql( "Select '*' from 'table1' where "+c)
// Display the layout using the new query
layout("Untitled","Select")
```



The layout might look something like this screenshot 1.

Searching

If you click on the Fill button it should fill the database with 191 records, each of which has a different single character between Ascii 65 and Ascii 255 in a random order. If you now enter the letter "a" into the unbound field in the header and click on the "Search on" button you will find that 14 records are selected. This shows that Datapower's search routine treats them as identical although they are obviously different characters with different Ascii codes. They are:

A,a,À,Á,Â,Ã,Ä,Å,à,á,â,ã,ä,å

As you can see, they are all variants of the letter A with or without an accent. The same is true for all the vowels.

e retrieves 10 characters,
E,e,È,É,Ê,Ë,è,é,ê,ë

i retrieves 10 characters,
I,i,Ì,Í,Î,Ï,ì,í,î,ï

o retrieves 14 characters,
O,o,Ò,Ó,Ô,Õ,Ö,Ø,ò,ó,ô,õ,ö,ø

u retrieves 10 characters,
U,u,Ù,Ú,Û,Ü,ù,ú,û,ü

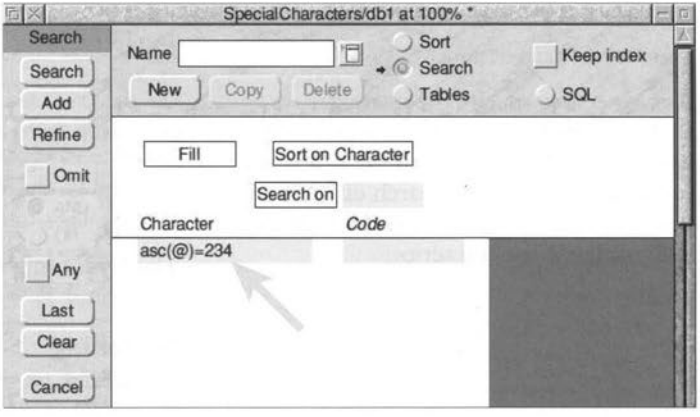
y retrieves 7 characters, Y,y,Ŷ,ŷ,Ÿ,ý,ÿ.

Three other characters retrieve more than just the upper- and lowercase letter:

c retrieves 4 characters, C,c,Ç,ç

n retrieves 4 characters, N,n,Ñ,ñ

w retrieves 4 characters W,w,Ŵ,ŵ.



2

If you want to search for just a specific accented character then you have to search for its Ascii code rather than the character itself. For instance, to search for ê (e-grave, which has an Ascii value of 234) then you need to search for that value. In our database you could search directly on the Code field or enter the Ascii code into the input field, but in general you might not have such a field or facility. In that case you can put

```
asc(@)=234
```

into the Character field in the search window, as in screenshot 2.

Sorting

Clicking on the Sort on Character button will sort the currently displayed subset. If the subset is the result of a single-character search then the sort will do nothing.

The reason here is that, as far as Datapower is concerned, all the displayed characters are identical and Datapower leaves them in the order in which they appear in the records.

Summary

We have seen that Datapower not only treats upper- and lowercase versions of the same letter as identical when sorting and searching but it also treats accented versions of a letter as having the same value as well. However, we have also seen how to search for a specific character within these groups.

Example to download

An example database, called Accents/db1, is as described in the article and can be found on the Archive website (click Files).

Next time

At this time I have no specific topic in mind for next time; suggestions welcome. Please contact me about any aspect of this article, Datapower2 or Datapower3, either by email or by post via the editor.

Julian Fry *julianfry@orpheusmail.co.uk*

Julian is pleased that he was not tempted to travel to try to find the sun this summer, when it has been far more evident here than in many holiday resorts abroad.

Compiling with GCC 4.1.1 Part 18

Rob Johnson

GCC (GNU Compiler Collection) is ported from Linux to RISC OS. As an operating system, RISC OS is very different from Linux, which makes porting difficult. This limits the frequency with which new versions of GCC can be copied across, so we have seen only a subset of the versions on Linux. Some changes have been made in our 4.1.1 version to make porting to RISC OS simpler.

Last time I mentioned, among many other things, the new freestanding machine-code assembler called asasm in GCC 4.1.1 Release 2. This is designed to handle assembler source in a similar format to Acorn/Castle's !ObjAsm. I said that it is a descendant of the assembler as, which is built in to versions of GCC prior to 4.1.1 – but that the thing called as inside 4.1.1 GCC is very different.

I believe that some of the major changes between RISC OS GCC's versions 3.4.6 and 4.1.1 are there to simplify the porting of versions of GCC from Linux. For instance the Linux system is based on ELF files. Prior to 4.1.1 much work may have been needed each time to rewrite the software to use Acorn's distinct types of file. Now 4.1.1 is ELF-based.

The change in as is another such feature. The compilation phase of GCC outputs assembler source which the as phase converts to object code. Linux has its own standard for assembler source (which can be applied to any actual machine's assembly language), which is again different from Acorn's. Prior to 4.1.1 each ported version of GCC was altered to output Acorn-style intermediate assembler source. An existing RISC OS assembler as was used to handle that, and also any external assembler sources. Now as has been replaced by a port of the Linux assembler phase, and the GCC team does not need to modify the intermediate assemble source.

But this meant that users who only had GCC 4.1.1 couldn't handle old assembly-language source files. Until Release 2 gave us asasm.

Last time I briefly looked at the differences between assemblers and found that 4.1.1's as rejected many things which the other assemblers accepted. I compared it with two versions of the old assembler: Acorn/Castle's !ObjAsm and 4.1.1's asasm. But I also came across three minor but crucial differences between these two assemblers.

At the time I gave up at that point, because I am not very familiar with RISC OS's assembler. This month I have chosen to dig a little deeper. With a caveat. In previous articles I have sometimes got hold of the wrong end of the stick. My assembler-ignorance means that this time I may sometimes have the wrong stick altogether.

Plan of campaign

My aim was to create simple assembler sources to demonstrate the differences in what is acceptable by !ObjAsm, 4.1.1 asasm, 3.4.6 as and 4.1.1 as. I began by following up the differences I had found between the first two, and also added 3.4.6 as into that mix. This should have removed a level of confusion and given me a firm basis to compare them with the very different 4.1.1 as.

But before that I needed a simple way of

running the assemblers for simple single-source files. Acorn/Castle's !ObjAsm frontend exists already. The various versions of the gcc and g++ programs already run the assembler named as when presented with a file in an s directory. I just had to modify my simple !Compile application to direct things that way with a Compile_s obeyfile in the relevant !GCC.bin directories. I handle the new asasm with a clone of !Compile called !Asasm for 4.1.1, and an Asasm_s obeyfile in 4.1.1's !GCC.bin.

Note that !Asasm will work only when 4.1.1 Release 2 is the active version of !GCC (and its !SharedLibs is also running).

With these extensions in hand, I could try assembling RISC OS Open Ltd's file wordwrap, used within !Edit, !Paint and !Draw. (It was assembling this file that highlighted differences between the assemblers in the first place.) I figured this should give me a reasonable variety of source code to put the assemblers through their paces. From what I find in there I can construct my simpler sources to highlight specific features.

To make modulewrap's assembly work, I had to copy across some extra files from !Edit: s.AppName, s.ResFiles and Resources.Export. I also had to use an obeyfile to create an Hdr: path pointing to the Hdr directory within ROOL and to its various subdirectories. I used this same obeyfile to set up an environment variable `Machine` with the value `Tungsten`, which modulewrap needs in order to find one particular Hdr file. None of these things will be required by the simpler example files that I will provide for you.

Now I was ready to assemble modulewrap with Acorn-style assemblers. And to discover that their three minor differences are not quite what I thought they were. And that 3.4.6 as has wider problems.

3.4.6 as

In my series of articles on compiling ROOL C sources with GCC (*Archive 20:12 to 21:6*), it never occurred to me to use GCC to "compile" ROOL assembler sources too. If I had I would have discovered that 3.4.6 as doesn't like a lot of the code that modulewrap calls in from Hdr: files.

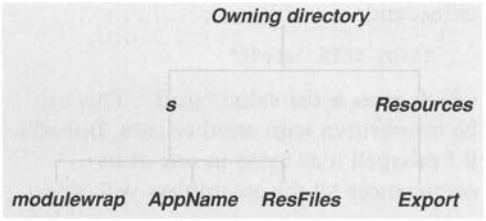
It turns out that as didn't implement some of !ObjAsm's directives (instructions to the assembler). In particular I have identified `OPT`, `TTL` and `SUBT` as missing, all of which control the assembly listing. There are also some built-in variables, identified by `{...}`. Most of them work, but as doesn't have `{OPT}` and `{ENDIAN}`. Apart from `{ENDIAN}` all the things mentioned in this paragraph are heavily used by the Hdr: files.

As a result, assembling modulewrap with 3.4.6 as spews out a lot of error messages and no object file. However, I was able to detect the error messages relevant to the following problems, buried in among the other stuff. And it didn't affect my simpler example files.

Failing to find a file

With the Hdr: path set up the assemblers were able to locate all of the assembly language header files modulewrap asks for, and s.AppName and s.ResFiles could be found directly. But only !ObjAsm appeared able to see Resources.Export. All the other files are assembler sources read in via `GET`, the assembler equivalent of C's `#include`, but Resources.Export is accessed in a different way.

`GET` works like `#include` because it is designed for dragging in extra assembler source files. It can be given a full filename such as Hdr:ResourceFS. It can search



directories mentioned in the assembler command line. Or it can find files locally. As usual, locally means in the directory that owns the source directory. Thus `GET s.Appname` finds Appname in the same s subdirectory that contains modulewrap.

Similarly `GET Resources.Export` would find the file in the neighbouring subdirectory Resources. But Export can't work that way. It is a Basic program source which the assembler must set up to be run as Basic.

The way this is achieved in modulewrap is surrounded by layers of complexity, most of which are irrelevant to the actual error that results. The file s.ResFiles contains the line

```
ResourceFile Resources.Export,
Resources.Edit.Export
```

`ResourceFile $InFile, $OutFile` is a macro defined in Hdr:ResourceFS. There are several peculiarities surrounding the use of this macro. But the essential element for the problem under consideration is in generated lines such as

```
DCD :FSIZE:"Resources.Export"
```

I think that such file references obey different rules from `GET`. They will accept full pathnames. I'm not sure if they will take notice of entries in the command line. But they certainly don't look locally.

Notice that this particular line requires compile-time access to Export because the `FSIZE` macro gets hold of the size of the file and stores it in the object code. I believe some other lines in the `ResourceFile` macro don't cause assembler or linker errors because they merely store a filename for run-time access. And I'm not going to continue my investigation in that direction.

So how come !ObjAsm finds Resources.Export when the other assemblers don't. Well, it turns out that !ObjAsm *does* look in the RISC OS work directory, as you can prove by changing the work directory before assembling FileTestBad with !ObjAsm. Usually the work directory is set to just where we want it, if only because my !Compile and !Asasm set it there. But it doesn't help with their assembling, because as and asasm don't use it.

My solution was to create an obeyfile SetRes which creates a path Res: pointing to the directory that owns Resources (and s). And change the contents of s.ResFiles to

```
ResourceFile Res:Resources.Export,
Res:Resources.Edit.Export
```

All three assemblers then had no problem with this aspect of modulewrap.

I haven't given you a copy of modulewrap and all its necessary files. But you have example FileTestBad which demonstrates the problem, and FileTestGood which solves it with Res: path. Now after you run SetRes all the assemblers will be able to find a file called Resources.dummy for FileTestGood.

Case-recognition

There is a second instance in modulewrap where !ObjAsm accepts something but as and asasm don't. This involves a symbolic name which has accidentally been spelt with one of its letters in the wrong case. At first it seemed that !ObjAsm ignored case in names while as and asasm took notice of it. But this turned out to be far from the truth.

I quickly discovered that all the assemblers

took case seriously in data names. For example

```
thing DCD 0
Thing DCD 0
```

define two different pieces of numeric data.

We will see that the object at the centre of the current problem is not data but a symbolic variable. But here again we will find that case matters for all the assemblers.

Symbolic constants and variables

The definition of `thing` above creates an appropriately-sized space in the object code output by the assembler. Symbolic variables on the other hand don't create any object space: they are pieces of information used purely by the assembler, controlling details of other parts of the assembly. For instance the setting of a symbolic variable might determine whether debugging code is included in the output.

There are symbolic constants as well as symbolic variables. Symbolic constants are created with a value fixed for the duration of the assembly. But symbolic variables are set up a different way, allowing their contents to be changed at various points in the source.

Symbolic constants can only be numeric. They are defined by

```
thing EQU number
```

or the `EQU` can be replaced by `*`.

Symbolic variables can be numbers, strings or Boolean values, and can be declared locally or globally. The example we will be concerned with is

```
GBLS thing
```

which creates a global string variable called `thing`, and

```
thing SETS "stuff"
```

which gives it the value "stuff". This can be overwritten with another `SETS`. But still if I misspell it as `thiNg` in one of its occurrences all the assemblers will object.

So far we are failing to find a reason why !ObjAsm accepts something the others don't. But the next step in the investigation will turn the question on its head.

$ substitution

The actual code that as and asasm object to in modulewrap involves something called $ substitution. Consider for instance the following code involving string variables `thing1` and `thing2`:

```
thing1 SETS "stuff"
thing2 SETS "$thing1"
 DCB "$thing2"
```

!Objasm's documentation says that the assembler will replace `$name` with the contents of variable `name` before getting on with the meat of the assembly. In other words, the above code becomes

```
thing1 SETS "stuff"
thing2 SETS "stuff"
 DCB "stuff"
```

The last line is the only one which generates any output, a chunk of object space containing the letters s,t,u,f,f, as can be verified by peering inside the object file.

It is at this point we find the first crack in the armour. !Objasm and asasm do as described above. But 3.4.6 as ignored $ substitution (as asasm's Changelog seems to confirm), and as a result the last line just put the letters $,t,h,i,n,g,2 in the output file. But still with no error message at assembly time. (Note that this proves only that `DCB "$thing2"` was mishandled by as. I

can't actually say anything about `thing2 SETS "$thing1".`)

(There is an as parameter `-objasm` which is supposed to make as behave even more like !ObjAsm. It doesn't do any good here. And in my limited experiments I haven't found any example of where it does make a difference.)

If I now misspell either `"$thing1"` or `"$thing2"`, say with an uppercase N, I find that !ObjAsm and asasm don't complain, but they do notice. The rule seems to be that an unrecognizable `$name` should be just left as it is, producing results similar to those of as. You can explore this by playing around with file NameTest1.

So now I have all three assemblers *not* complaining about the wrong case in a symbolic name (as because it doesn't even recognize that `$name` is supposed to *be* a symbolic name). The question becomes: What makes as and asasm object to a misspelling in a particular *use* of $ substitution?

Note that $ substitution can use the names of any kind of symbolic variables. The legality of the substitution depends only on the legality of the resulting code. But numeric symbolic variables can also be used without $ substitution. And symbolic constants don't support $ substitution. Note also that arithmetic can be performed on any numeric objects, with or without allowed $ substitution. This can be seen in file Symbolic.

Actually Symbolic reveals more than that. The position stated in the last paragraph is that of !ObjAsm. But it turns out that as and asasm are more lenient, and allow $ substitution with symbolic constants. At last we have a difference between !ObjAsm and as/asasm. But unfortunately it isn't the smoking gun we're looking for.

Macro parameters

Now it is time to show you the actual line that causes the problem with my assembling of modulewrap.

One of the Hdr: files NewErrors defines error messages. It creates one such with

```
AddError BadNetFSFilename,
$ErrorString_BadFilename, ErrorBase_NetFS
+ ErrorNumber_BadFileName
```

And that is where the error is notified by as and asasm.

The macro `AddError $name, $text, $value` is defined in Hdr:Macros. It creates a numeric symbolic constant `ErrorNumber_$name` containing `$value` and a symbolic string variable `ErrorString_$name` holding `$text`. (A string variable whose value is set only once is the nearest thing you can get to a string symbolic constant.)

Note that $ substitution is here extended to use on macro parameters, allowing the contents of `$value` and `$text` to be transferred. But it is also used in the specification of the unique symbolic names `ErrorNumber_$name` and `ErrorString_$name`.

For instance NewErrors has earlier used

```
AddError BadFileName, "Bad filename", 204
```

to create `ErrorString_BadFileName` with value "Bad filename" and `ErrorNumber_BadFileName` with value 204.

Now

```
AddError BadNetFSFilename,
$ErrorString_BadFilename, ErrorBase_NetFS
+ ErrorNumber_BadFileName
```

attempts to build another error message based on the earlier one, expecting to create `ErrorString_BadNetFSFilename` with the same value as `ErrorString_BadFileName` and `ErrorNumber_BadNetFSFilename` from `ErrorNumber_BadFileName` shifted by

`ErrorBase_NetFS`. (Note the omission of $ substitution for numeric symbols.)

As you can see, the author accidentally didn't capitalize the N in `$ErrorString_BadFileName`. (I think he had to spell `ErrorNumber_BadFileName` correctly to avoid an assembly error. But he adds to the confusion by calling his new error `BadNetFSFilename`, also without the cap N.)

My file NameTest2 shows what the assemblers do with such a macro situation. If I pass a valid symbolic object into my simple macro, then all three assemblers do $ substitution, including as. They also all apply $ substitution correctly inside the macro. My choice of macro contents even proves that as correctly translates `DCB "$string"` inside a macro, which it failed to do outside a macro.

If you misspell the parameter in the macro call, you will find that !ObjAsm leaves it unsubstituted, as it did in the last section for substitution without macros. But asasm now complains about misspelling, in the specific instance of a macro parameter. As does 3.4.6 as. And we have duplicated the problem as seen in modulewrap.

The obvious solution was to correct the spelling in NewErrors, and then all three assemblers were happy. None of the assemblers were actually specifically concerned about the case of letters in the names of things. It was all really to do with generalized undefined objects.

But my investigation has uncovered a few differences in detailed action in the three assemblers. And as exhibits different behaviour inside and outside of macros. Which just shows how easy it is to interpret the specification of a complex piece of software in subtly different ways. And in this case !ObjAsm's documentation doesn't actually say what should happen to $ substitution of non-existent symbols.

More significantly perhaps I discovered that the version of Rool's NewErrors that I have doesn't actually do the right job, even under !ObjAsm. I set up another test file (which I haven't included because it would have required too many of Rool's files to be copied for you) and examined the object file it created. I found that `DCB "$ErrorString_BadFileName"` correctly stores "Bad filename" whereas `DCB "$ErrorString_BadNetFSFilename"` stores the only partially converted result "$ErrorString_BadFilename".

Files to download

My old simple compiler application !Compile is a copy from my very first article. !Asasm is a clone of that modified to run asasm rather than gcc or g++, for assembler sources only. Directory !GCC.bin contains my original Compile_c and Compile_cc files to run C/C++ compilations, plus the new Compile_s and Asasm_s to assemble machine code using as (via gcc/g++) and asasm respectively.

SetRes, s.FileTestBad, s.FileTestGood and Resources.dummy are provided to test file finding.

s.NameTest1-2 and s.Symbolic are involved in the case-recognition saga.

All of this can be downloaded from the Archive website (*archivemag.co.uk*) – go to the Files section for this issue.

Rob Johnson *robfj@robfj.bbmax.co.uk*

Weather in Southport is miraculous as I write. We like to spend afternoons gardening. Our vegetables have been wishing for rain for weeks. Now it rains every night and morning – but clears away in the afternoons so we can go out!

The secret life of algorithms Part 5

Nicholas Cutler

In the last article of this series (*Archive 22:12*) I started to look at algorithms with an obvious practical application. This instalment will continue the theme by examining an algorithm that is in widespread, possibly even everyday, use.

Fast Fourier Transform

The procedure in question is the Fast Fourier Transform (FFT). At first, this may appear to be an esoteric mathematical method of rather limited interest, but it has found considerable utility in signal processing, particularly of digital audio. Readers of Archive will, no doubt, already be aware of this importance through Jim Lesurf's Sound columns. For that reason, I will stick to digital audio for my examples this month.

The purpose of the FFT is to take as its input a series of discrete, regularly spaced, samples of the sound, and to compute the relative strengths of the different frequencies which make up the original sound. In mathematical terms we are trying to model the original waveform as a sum of a series of sine waves of different frequencies. It is this property which has seen the algorithm's application in MP3 compression, achieving significant savings in storage space by removing frequencies to which the human ear is not particularly sensitive.

Go with the description

The formal description of the FFT does, by necessity, involve quite a bit of mathematics. For that reason, I was reluctant to include the algorithm in this series, but decided that ultimately its wide application is sufficient reason to cover it. Throughout this article it is far more important to follow the description than it is the detail of the mathematics.

To begin with, suppose we sample the sound we wish to analyse at N evenly spaced points. The amplitude at each point is then represented by x_i. The mth frequency component of the original sound, that is the figure we are trying to calculate, will be denoted by $X(m)$. Then, if modelling the sound using sine curves, a periodic-wave-like function, $X(m)$ can be obtained from:

$$X(m) = \sum_{n=0}^{N-1} x_n \sin \frac{2\pi nm}{N}$$

In effect, this is saying that we take each of the samples in turn, and then multiply them with the corresponding value of a pure tone of a single frequency, and add up all of the resulting products.

Real sound

Of course, when modelling real sound, it is necessary to consider the phase as well as the frequency. Put simply, if we take two identical sounds, and shift one relative to the other along the time axis, then the two are out of phase. Although individually they still sound the same, the sample values at any given time are different. Therefore, it is necessary to extend the model to include cosines (like the sine, but shifted by quarter of a cycle) as well.

At this point, to give a more mathematical description it is convenient to start using complex numbers. For those unfamiliar with the concept, think of a complex number as being analagous to a point on a

two-dimensional plane, specified by its horizontal and vertical position. An alternative way of giving the location of this point would be to measure the distance from the centre of the plane, and the angle from the horizontal. This property enables us to consider both the magnitude and phase of a frequency component at the same time.

Polar approach

Keeping this analogy in mind, it is convenient to use the distance from the origin to our point on the complex plane, to represent the magnitude, and the angle for the phase. In more mathematical language these are known as the *modulus* and *argument* respectively.

Similarly, if these two quantities are given, and we wish to find the horizontal and vertical coordinates of the original point, this can be done using trigonometry. I hope this demonstrates in a more intuitive way how one single point on the complex plane can account for both the sines and cosines in our model.

In all of the following mathematical descriptions I have used i for the imaginary component (the square root of -1), but it is worth remembering that engineers sometimes use j instead. Hence, our expression for the $X(m)$ coefficients becomes:

$$X(m) = \sum_{n=0}^{N-1} x_n \left(\cos \frac{2\pi nm}{N} - i \sin \frac{2\pi nm}{N} \right)$$

$$X(m) = \sum_{n=0}^{N-1} x_n e^{-i2\pi nm/N}$$

Essentially these are the same as the first equation, but using both the sine and cosine functions – and using complex numbers to represent phase and magnitude simultaneously. Both forms are equivalent; the second one is derived from the first using Euler's relationship. It is beyond the scope of this article to provide a proof of this result, but those readers with some mathematical knowledge may enjoy deriving it by considering the power-series expansion of the sine and cosine functions. This second form is often easier to work with mathematically, but as many programming languages do not provide an easy way of working with complex numbers, the first form may be simpler to implement.

These equations, therefore, give us a working method for finding the frequency spectrum of a digital signal, and one that can be implemented on a computer. To demonstrate this a simple Basic program using this method can be downloaded from the Archive website (click Files).

More efficient

It is, however, a computationally inefficient method. Computing all the frequency components esentially takes a number of operations in proportion to N^2, the square of the number of samples in the original signal. For any useful signal-processing, this rapidly becomes excessively time-consuming.

While it is possible to avoid having to calculate all of the sines and cosines by using the well known recurrence relations, as my program does, this still involves N^2 multiplications of complex numbers.

In much the same way as it was possible to speed up the sorting algorithm (in the first of this series, *Archive 22:6*) by using a recursive approach, this method can also be made more efficient. Using the technique of "divide and conquer", it is indeed possible to reduce the task to that

of calculating two shorter Fourier transforms, and so on. To show how this is done involves some algebra to rearrange the above formulae.

Save some writing

First, to save writing, we will use the shorthand $W_N{}^j$ to represent $e^{-i2\pi j/N}$. Then, the trick is to consider even and odd terms from the sum independently. This has been done in the second equation below. Note that $W_N{}^{(2n+1)m}$ can be written as $W_N{}^{2nm}W_N{}^m$, and to convince yourself of this, you may find it useful to expand each as the equivalent exponents. This means that the common factor of $W_N{}^m$ can be taken outside of the second summation. Finally, $W_N{}^2$ can be written as $W_{N/2}$, since $e^{-i2\pi 2/N} = e^{-i2\pi/(N/2)}$. This is done in the third line below:

$$X(m) = \sum_{n=0}^{N-1} x_n W_N^{nm}$$

$$X(m) = \sum_{n=0}^{N/2-1} x_{2n} W_N^{2nm} + W_N^m \sum_{n=0}^{N/2-1} x_{2n+1} W_N^{2nm}$$

$$X(m) = \sum_{n=0}^{N/2-1} x_{2n} W_{N/2}^{nm} + W_N^m \sum_{n=0}^{N/2-1} x_{2n+1} W_{N/2}^{nm}$$

Essentially this has split the summation into two parts, each half the length of the original, and which combine to produce the FFT. The point to notice, however, is that, apart from the index of the x coefficients, the content of the two summations is basically the same.

This is good news as it halves the number of complex exponents (or equivalently sines and cosines) which we have to calculate. The computer is able to calculate both sums in a single loop, utilizing the same exponents for each. This is an important saving, but it is still possible to do better.

A step further

The next stage is to consider whether the higher-frequency components in the transformed sequence can be derived in terms of the lower-frequency components. In the mathematical notation used above, we are trying to find an expression for $X(m+N/2)$. Accordingly, it is sufficient to substitute $m+N/2$ in place of m in the previous set of equations, before undertaking further algebra to simplify the result.

Conscious of the need to keep this explanation as accessible as possible, and to move on to the implementation of the algorithm, I have taken the liberty of omitting the intermediate stages in this derivation. This principally involves some work with the W terms to give the result shown at the bottom of the page.

Again, without worrying too much about the details, the point to notice is that apart from a change of sign in front of the second summation this is identical to the previous equation. The practical consequence of this is to compute the upper half of the $X(m)$ components in terms of the lower half, with esentially no extra work. Furthermore, the technique works recursively, splitting the computation into a smaller one at each step, making it feasible to carry out a Fourier transform on digital audio signals in real time.

Now for the computer

With all of the mathematical principles in place, it is now possible to implement this

$$X(m+N/2) = \sum_{n=0}^{N/2-1} x_{2n} W_{N/2}^{nm} - W_N^m \sum_{n=0}^{N/2-1} x_{2n+1} W_{N/2}^{nm}$$

algorithm on the computer.

The main difference between the mathematical description as a recurrence and the computer program is motivated by the need to make the algorithm run as fast as possible. While it would be quite possible to write a recursive procedure (one that calls itself), this would be unnecessarily inefficient in this case. Although it has the appearance of elegance in a high-level language, the computer needs to keep track of many instances of the same procedure (as it calls itself), each of which needs to remember its own local data. Similarly the requirement to pass arrays into and out of the procedure further complicates matters for the computer.

Iteration rather than recursion

Fortunately, however, there is an alternative formulation of the same idea that can be implemented iteratively. Recall from the above equations that we basically split the Fourier transform into two halves, one on all of the even-numbered data points, and another on the odd points. This trick is then applied over and over, giving a sequence of transforms on even or odd points until we have reached a single data point in each case.

For each of the x_i data points, there is a unique sequence of even and odd "parts" leading to the transformed version. Thus, if we take care of this ordering by swapping elements of the original input array over, the application of the Fourier transform is much simpler. First copy each of the elements into the output, taking care of the one-point transforms. Next join adjacent pairs to compute the two-point transforms, then carry on in a similar way until eventually the two halves are joined to give the final FFT.

Finally, as we have to use complex numbers to represent the result and intermediate calculations, it is necessary to to leave extra space in the input array to accomodate both the real and imaginary parts of each. Hence, there are two elements in the input for each data point, and it is often initially sufficient to leave all the imaginary parts as zero.

Doing it in Basic

Keeping this formulation in mind, the entire procedure can be implemented in BBC Basic as follows:

```
DEFPROCfftmain(N%)
LOCAL NN%,M%,Mmax%,istep%
PROCfftreverse(N%)
NN%=N%<<1
Mmax%=2
WHILE NN%>Mmax%
istep%=Mmax%<<1
theta=2*PI/Mmax%
wtemp=SIN(0.5*theta)
wpr=-2*wtemp*wtemp:wpi=SIN(theta)
wr=1:wi=0
FOR M%=1 TO Mmax%-1 STEP 2
FOR I%=M% TO NN%+M%-istep% STEP istep%
J%=I%+Mmax%
tempr=wr*x(J%-1)-wi*x(J%)
tempi=wr*x(J%)+wi*x(J%-1)
x(J%-1)=x(I%-1)-tempr
x(J%)=x(I%)-tempi
x(I%-1)+=tempr
x(I%)+=tempi
NEXT
wtemp=wr
wr=wr*wpr-wi*wpi+wr
wi=wi*wpr+wtemp*wpi+wi
NEXT
Mmax%=istep%
ENDWHILE
ENDPROC
:
```

```
DEFPROCfftreverse(N%)
LOCAL I%,J%,M%,NN%
NN%=N%<<2
J%=1
FOR I%=1 TO NN%-1 STEP 2
IF J%>I% THEN
PROCswap(J%-1,I%-1)
PROCswap(J%,I%)
ENDIF
M%=N%
WHILE (M%>=2 AND J%>M%)
J%-=M%
M%=M%>>1
ENDWHILE
J%+=M%
NEXT
ENDPROC
:
DEFPROCswap(A%,B%)
temp=x(A%)
x(A%)=x(B%):x(B%)=temp
ENDPROC
```

The bulk of the computation of the actual Fourier transform is carried out in `PROCfftmain`, which first calls `PROCfftreverse` to rearrange the elements of the input array into the right order. As this and all subsequent operations on the data array `x()` are carried out in situ, there is no need to explicitly pass this into either procedure.

Next, some initial values of the sine and cosine functions are calculated, with the work of combining adjacent elements being carried out in the two nested `FOR` loops. Finally the values of the trigonometric functions are updated using the recurrance formulae ready for the next pass of the outer loop.

One additional point is that `PROCfftreverse` uses `PROCswap` to exchange two elements of the array. This is only to aid readability in this program, and for speed the instructions would ordinarily be integrated in the `fftreverse` procedure.

For those wishing to experiment, the complete Basic program can be downloaded from the Archive website (Files section). An extra procedure is included to build a series of samples of a waveform that the Fourier transform code can analyse.

Summary

This article has examined one of the most important algorithms in digital signal processing and shown how a faster, more practical implementation can be derived.

Some of the remaining articles in this series will allude to ways in which this, or similar, methods have been used for some interesting applications.

More immediately, however, the next part will include less mathematics!

Nicholas Cutler *ncc25@cam.ac.uk*

Nicholas in action during the Cambridgeshire Rowing Association's winter league. His body position suggests he is trying to turn a corner.

Going around in circles Sound 30

Jim Lesurf

When playing digital audio files and sources we have to supply a DAC (digital-to-analogue converter) with a series of digital sample values; it then converts these into the required analogue waveforms. This process and the information carried are normally described in terms of a sequence of binary numbers. So we might expect that all that is needed is to supply the DAC with the correct series of numbers in the right order. Ideally, the samples being presented are converted in a perfectly uniform clock-like manner. The time interval between each sample and the next should be perfectly regular and uniform.

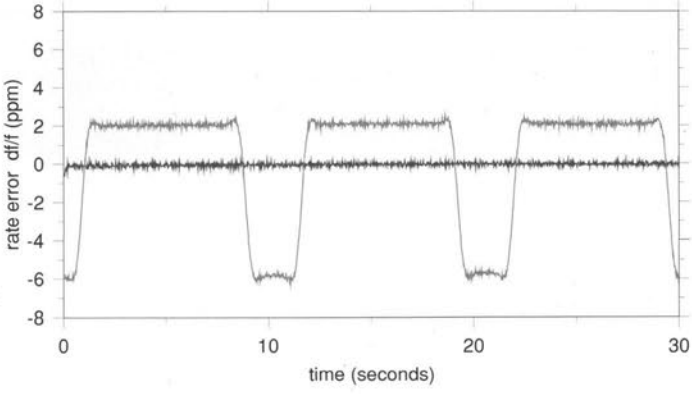
Alas, work on practical systems show there are often timing errors or irregularities which can upset the details of the analogue output. This is where the time between successive sample value conversions keeps varying in some way. The result is a subtle distortion of the output analogue waveforms. The departures in timing from perfectly uniformity are called "jitter". If you look at audio magazines you can often see measurements on CD (and DVD) players that show some kind of spectrum and give a measured jitter value, usually in units like picoseconds (ps).

For domestic audio players such as CD the standard way to measure this is to use what has come to be called the J-Test. The J in the name is for two reasons. One is the obvious – the initial of "jitter". The other is that the standard method was devised by an engineer called Julian Dunn. The technique he devised is aimed at probing the specific weaknesses of the way CD and DVD players tend to send the digital data to the DAC. Alas, computers work in a very different manner when they are used to play sound files or internet radio streams. So the J-Test may not be the most useful way to test using a computer to play music.

JL's IQ

I've been puzzling over this for some time and I finally came up with an alternative approach that doesn't make the same presumptions as the standard J-Test about the likely defects of what is being tested. For various reasons I couldn't resist calling it the IQ-Test.

The graph below shows the results of applying the IQ-Test to my Shuttle home computer system when it plays a 48ksample/sec 16-bit sound file using a good external DAC (Cambridge Audio Dacmagic). The vertical scale (rate error) essentially shows the rate of replay of the file. The horizontal scale shows time (and the series of samples) passing. Note that



the graph is *not* displaying the output analogue waveforms being played. It shows how *quickly* the waveform is being played – in effect how sharp or flat it might sound, and how that varies with time.

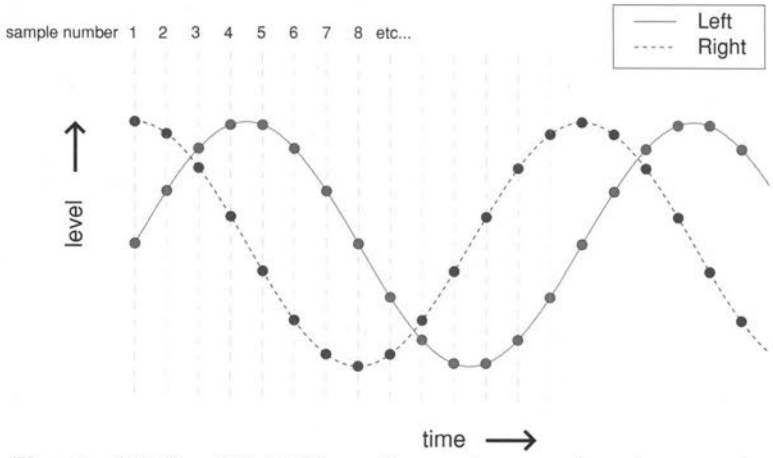


Figure 2 – Left (I) and Right (Q) waveforms and sequence of samples

Two lines are plotted on the graph. One is essentially a flat line at about 0. This shows the system playing the sounds at a uniform rate. The second line regularly jumps up and down from +2 to −6 ppm. This shows the rate of replay changing in a way that it shouldn't. The jumps occur when I use a direct USB connection. The steady uniform result is when I send the sound data via a Halide Design USB-to-SPDif Bridge (converter). The improvement is quite obvious. However, the jumps are on a timescale that the standard J-Test would probably miss detecting.

Sine and cosine, left and right

Any communications engineers who read this might already have also spotted that "IQ" may be more than a pun on "J" or my thinking my new test is clever. IQ modulation and demodulation is a common technique in modern digital communications.

The trick is to use the left and right channels of the stereo signal to carry a related pair of waveforms – a sine and cosine wave of the same frequency and amplitude. This produces an IQ waveform like the example shown in Figure 2. You can think of the left and right pair of values at any instant as being the real and imaginary parts of a complex number. Communications engineers think of them as the "In phase" (I) and "Quadrature" (Q) parts of the signal. The advantage of this approach is illustrated in Figure 3.

This shows the sequence of left-right values plotted on an XY-graph. The effect is to step around a circle because the left and right values are essentially the sine and cosine of a value which we can think of as a steadily changing angle. The result is like a hand moving around a clock-face. It allows us to represent the passage of time.

When a DAC converts the sequence of left-right value pairs into a pair of output analogue waveforms we can then use them to "tell the time" at any instant.

If the replay process is converting the series of left-right pairs with precisely correct and uniform spacings then the clock we measure will run accurately and smoothly. Any delays or variations in the times at which each successive left-right pairs are converted to analogue will mean

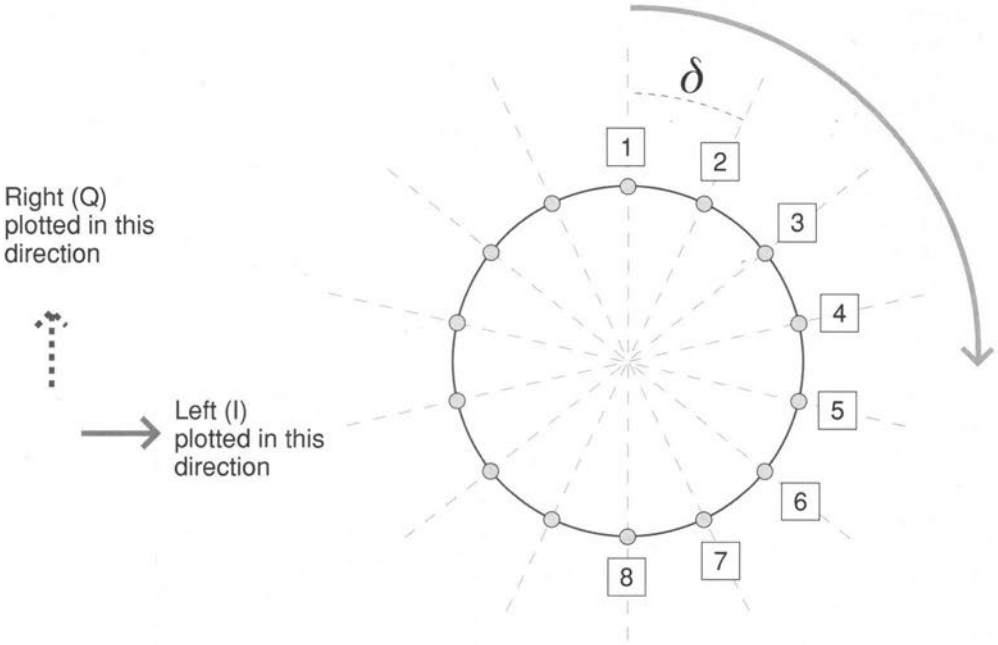


Figure 3 – Left and Right sample pairs step around in a circle.

the "hand on the clock" won't be rotating smoothly at the correct rate.

Programming in C

In the C programming language the way this works can be outlined as follows.

Start by defining a test IQ waveform frequency and amplitude. Choose the sampling rate of the test waveform to be played by the system via the DAC and from that choose the time interval between successive sample pairs. Then use this to build an LPCM Wave file containing the required sequence of stereo sample pairs. Play the file and record the results using some type of digital recorder.

Note that the sample rate (etc) of the recorder does not have to match exactly the rate of the test signal since we are recording the analogue output of the DAC. In principle you can use sound inputs to another computer to make the recording and collect the data. However, to do this you would need to be happy that this second computer doesn't have its own timing problems!

This gives us a recorded set of data values we can call `left[i]` and `right[i]` taken at a series of recorded instants `t[i] = i*dt`, where `dt` is 1 divided by the sampling rate of the recording we made from the DAC output. For each sampled instant we can now calculate a phase (angle of the hand on the clock face):

```
phi[i] = arctan2(-left[i],right[i])
```

To determine how swiftly the clock hand is moving (i.e. the actual rate of replay) we can then calculate the change in phase between each successive pair of recorded values:

```
dphi[i] = phi[i]-phi[i-1]
```

By default in the C language these values will be in radians.

Finding fluctuations

You can also argue that the frequency of a sinusoidal wave is related to the rate of change of its phase. So we can then work out the effective frequency during each interval between successive pairs of samples using

```
f[i] = dphi[i]/(2.0*pi)
```

This can then be used to determine the actual rate at which samples were converted and played out as an analogue stereo waveform. Thus we discover if the overall rate was incorrect and find any fluctuations. In ye olde analogue terms these variations might have been called "wow and flutter".

Undoing a jump

Note that `arctan2()` always gives a value for the phase within the range $\pm\pi$. So every now and then the values we obtain for `dphi[]` will "jump". This will happen once per rotation of the hand around the clock. The analysis program therefore has to keep an eye on this: whenever the value differs from its neighbours by more than π we need to adjust it by $\pm 2\pi$ to undo this jump.

This correction stitches together the series of phase-change values and removes the effect of movements across the boundary of the arctan function.

In practice it is useful to make recordings with a high sample rate and with 24-bit resolution to maximize the accuracy of the results. That said, recordings at, say, the CD standard should be quite OK for basic measurements and checks on a decent audio system. However, the results in Figure 1 were based on recording the DAC output with a recorder running at 192ksamples/sec and using 24-bit values. This makes it easy to see any variations in replay rate down to the level of a part per million (ppm) or less.

Files to download

As usual I've provided a copy of the two Risc os applications I used. One, !WAV_IQGen, will generate an LPCM Wave file containing an IQ sin/cos stereo pair which can then be played on a system you wish to test. The other, !WAV_IQTest, lets you analyse a recording you have made of the analogue output from the system and DAC being tested. Each application includes a helpfile that gives more details on how to use the applications.

At present the IQ-Test examines variations over the medium and long term – in other words, timescales from a fraction of a second up to more than 100 seconds. But I also plan to write another analysis program that examines timing variations on a sample-by-sample timescale and give results more directly comparable with the traditional J-Test.

Jim Lesurf *jcgl@audiomisc.co.uk*

Jim as intrepid astronomer atop 14,000ft Mauna Kea, Hawaii, about 1980. "I had rather more hair in those days," he says.

London Show 2011

*ROUGOL are pleased to announce that this year's show will have on display a development version of the **Raspberry Pi**. This exciting project plans to release a $25 ARM-powered computer, designed to kickstart the next generation of coders in the same way that the BBC Micro did back in the 80s.*

Will RISC OS be running on it by the time of the show? You will just have to turn up to find out!

Saturday 29th October 11am to 5pm

St Giles Hotel, Hounslow Road, Feltham, TW14 9AD

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